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7. Author's)
Samuel M. Fox, III, M.D.

9 . Performing Organization Name and Address
The Washington Consulting Group, Inc.
1625 Eye Street, N.W., Suite 214
Washington, D.C. 20006

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16. Abstract

This document represents the outcome of a conference sponsored by the Office of Motor Carriers to review the current medical standards covering commercial drivers with cardiovascular disease. The standard (49 C.F.R. section 391.41(b)(3)) permits qualification of individuals to drive a motor vehicle if that person has no current clinical diagnosis of myocardial infarction, angina pectoris, coronary insufficiency, thrombosis, or any other cardiovascular disease of a variety known to be accompanied by syncope, dyspnea, collapse, or congestive heart failure.

The standard (49 C.F.R. section 391.41(b)(6)) permits qualification of individuals to drive if that person has no current clinical diagnosis of high blood pressure likely to interfere with his/her ability to operate a motor vehicle safely.

During a 2-day conference, cardiologists, occupational health physicians, and motor carrier industry experts reviewed and proposed modifications to the cardiovascular regulations and recommended test procedures and decision matrices designed to guide cardiological examinations. Since the U.S. Department of Transportation's (DOT) cardiovascular standards for commercial motor vehicle drivers were adopted in 1970, meeting participants considered 16 years of advances in diagnosis, treatment, and rehabilitative techniques. Five task forces discussed and prepared reports on the following topics: (continued on next page)

17. Key Words	18. Distribution Statement
Ischemic Heart Disease -Hypertension and Peripheral Vascular Disease -Valvular, Myocardial, Pericardial, and Congenital Heart Disease(see next page)	

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16. Abstract

Ischemic Heart Disease; Hypertension and Peripheral Vascular Disease; Valvular, Myocardial, Pericardial, and Congenital Heart Disease; Dysrhythmias, Sudden Death, and Pacemakers; and Cardiovascular Pharmacologic Agents. These task force reports will assist DOT in creating a systematic and scientific basis for updating cardiovascular standards for commercial drivers.

17. Key words	18. Distribution Statement
-Dysrhythmias, Sudden Death, Pacemakers -Cardiovascular Pharmacologic Agents -Motor Vehicle -Traffic Accident -Driver	

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CONFERENCE
ON
CARDIAC DISORDERS AND COMMERCIAL DRIVERS

October 30-31, 1986

EXECUTIVE SUMMARY

INTRODUCTION

The U.S. Department of Transportation's (DOT) cardiovascular standards for commercial motor vehicle (CMV) drivers, unchanged since 1970, were discussed during a 2-day conference at the American College of Cardiology (ACC) in Bethesda, Maryland. During deliberations, cardiology experts, and management, and labor representatives from the motor carrier industry not only considered 16 years of advances in diagnostic, treatment, and rehabilitative techniques but balanced the need 1.0 protect the safety of the CMV driver and motoring public with the knowledge that. these standards would have an impact on the driver's livelihood.

Five conference rask forces, each chaired by a medical expert, considered the following topics:

- Ischemic Heart Disease.
- Hypertension and Peripheral Vascular Disease.
- Valvular, Myocardial, Pericardial, and Congenital Heart Disease
- Dysrhythmias, Sudden Death, and Pacemakers.
- Cardiovascular Pharmacologic Agents.

Through a consensus-building process, each task force produced a paper that contains evaluation data and decision data. The evaluation data specify a fundamental set of chemical blood and diagnostic tests that must be performed, outline the medical history and risk factors that must be reviewed, and identify followup testing to clarify ambiguous results or findings; the decision data establish guidelines for evaluating test results. Also addressed is the influence of cardiac risk factors on the incidence of coronary heart disease. These reports will assist DOT in creating a systematic and scientific basis for updating cardiovascular standards for commerical drivers. Summaries of these reports highlighting the important issues are presented in this executive summary.

BACKGROUND

Structure

The Bureau of Motor Carrier Safety (BMCS) (reorganized October 1986 into the Office of Motor Carriers (OMC)), part of DOT's Federal Highway Administration (FHWA), regulates commercial truck and bus drivers engaged in interstate or foreign commerce. This authority covers approximately 200,000 motor carriers of record and approximately 5 million drivers. Establishing and monitoring medical standards are among OMC's major responsibilities. The cardiovascular area is 1 of 13 subject areas covered by OMC's medical standards for CMV drivers, which 46 states have adopted thus far for the regulation of their intrastate CMV drivers.

Current Standard

The following regulations, established in l970, currently guide the cardiovascular and blood pressure examination. A person is physically qualified to drive a commerical vehicle if that person:

- Has no current clinical diagnosis of myocardial infarction, angina pectoris, coronary insufficiency, thrombosis, or any other cardiovascular disease of a variety known Lo be accompanied by syncope, dyspnea, collapse, or congestive cardiac failure.

- Has no current clinical diagnosis of high blood pressure likely Lo interfere with his ability Lo operate a motor vehicle safely.

These standards are applied through biennial physical examinations in which all commerical drivers, regardless of age, receive a stethoscopic examination and more indepth examinations for drivers who have a history of cardiovascular problems. Drivers are found either qualified or unqualified; no provisions exist. for restricting certification other Lhan shortening the 2-year certification period. The vagueness of these standards makes them subject Lo widely varying interpretation.

OMC works under a self-regulatory system that gives the motor carrier primary responsibility for applying the medical standards. A carrier may require its drivers to be examined by its own or its designated M.D. or O.D., or it may allow drivers Lo choose Lheir own physician. In addition, the carrier retains copies of the medical certificates and sometimes copies of the medical findings; DOT does not receive either item.

Because OMC probably will maintain the self-regulatory system, conference participants were urged Lo develop clear, structured standards for all cardiovascular conditions and specific guidelines for physicians.

PROCESS

Planning

A steering committee composed of seven medical and motor carrier industry experts was assembled to develop a conference format, select participants, and identify regulatory and medical issues. Committee members reviewed aspects of the cardiac standards that have caused problems, created an agenda, determined task force topics, and appointed task force leaders (see appendix A for list of steering committee members).

Conference

At the opening plenary session, background information was provided on commercial drivers and job tasks, existing cardiovascular standards, conference goals and objectives, and OMC's medical certification system (see appendix B for list of speakers). Dr. Roy Shephard, faculty of medicine at the University of Toronto, presented a paper on the medical/regulatory experience of the motor carrier industry in Ontario, Canada (see appendix C for paper).

After the plenary session, the participants divided into the five task forces. Four were composed of both medical and industry representatives; no industry representative attended the Valvular Heart Disease task force session.

A total of 36 persons participated in the task force sessions: 24 (67 percent) were physicians; 7 (19 percent) were management representatives; and 5 (14 percent) were labor representatives. Participants reviewed a paper prepared before the conference on their task force topic.

The following morning, the task forces' met to review these papers and revised them as necessary. The full conference then convened for the plenary session, during which a summary of each paper was presented and discussed (see appendix D for agenda).

SUMMARY OF REPORTS

Presented below are summaries of the task force papers.

Ischemic Heart Disease

Ischemic heart disease or coronary heart disease (CHD) is considered the major potential cause of acute incapacitating` illness in commercial motor vehicle drivers other than substance abuse and fatigue.

Coronary risk factors (CRF) should be defined in all interstate commerci.al drivers with professional union and industrial management support provided for early detection and preventive programs.

Ischemic heart disease may not be disqualifying if functional status suggests adequate reserves and low potential for dysrhythmia. Exercise tolerance testing is proposed as the main method for functional assessment of men over 45 years of age who manifest one or more CRF. It is not proposed to exercise test asymptomatic drivers without disease unless considered at "high risk" of developing disease by defined CRF criteria. Periodic individual evaluations are recommended, and a means for acquiring and analyzing disease and accident data throughout the industry are considered essential.

Hypertension and Peripheral Vascular Disease

With modern therapeutic capabilities most commercial motor vehicle drivers with hypertension should be able to continue driving. Hypertension predisposes individuals Lo target organ damage, particularly cerebral. and coronary compromise which requires continued effective blood pressure control and frequent evaluation for evidence of significant impending impairment. Therapy must not compromise mental alertness nor the ability to respond appropriately to environmental changes in temperature and both psychologic and physical challenges. Peripheral vascular disease of the limbs can be disabling, but modern therapy often can restore adequate function.

Effective preventive programs, supported by all concerned, should reduce mortality, morbidity, and early forced retirement in a highly cost-effective manner.

Valvular, Myocardial, Pericardial, and Congenital Heart Disease

Commercial drivers with many of the above conditions can be certi-f ied if free of significant cardiac impairment. and not prone LO disabling cardiac dysrhythmias. Surgical correction of many abnormalities has returned patients to normal or near normal function with documentation often not requiring invasive (heart catheterization) followup. Echo-Doppler studies, exercise tolerance testing, and ambulatory monitoring have provided adequate data in many cases. Some prosthetic materials are acceptable, but need for anticoagulation is considered disqualifying. Frequent followup is advisable and in some cases mandatory.

Cardiac Dysrhythmias, Sudden Death, and Pacemakers

In these areas, diagnostic and therapeutic capabilities have ad-vanced rapidly, but major concerns remain relative to sudden incapacita-ting events even with the best of both pharmacologic and instrumental approaches. Careful and extensive reviews of the clinical. history and real-life or ambulatory ("Holter") type rhythm monitoring are the initial approaches but "stress" testing and electrophysiologic studies of an invasive type (heart catheterization) may be needed to justify providing a clearance for interstate truck driving,. Debate continues concerning the ability to permit pacemaker-dependant persons Lo qualify for commercial motor vehicle driving.

Cardiovascular Pharmacologic Agents

Although therapeutic regimens can include a wide variety of pharmacologic agents without impairments contraindicating commercial motor vehicle driving, there are some agents that are particularly likely to compromise mental or cardiovascular capabilities. Clonidine, methyldopa, quanabenz, reserpine, and prazosin can either produce somnolence and/or impair reflex responses. Guanethidine is also likely to produce unacceptable orthostatic hypotension, causing inadequate cerebral blood flow. Most patients requiring amiodarone have conditions incompatible with commercial driving responsibilities, and many patients on anticoagulants have conditions of unacceptably high risk. Use of beta blockers is not a contraindication in itself, but careful individual evaluation is mandatory before recommending commercial driving responsibilities. Frequent followup and documentation of individual functional capabilities is mandatory with many of today's therapeutic agents.

POTENTIAL APPLICATIONS OF RESULTS

The conference findings can be applied to many enL.ities outside the commerical motor vehicle industry, including drivers in general and related industries. Some related industries include heavy construction and heavy equipment operation. Through labor and management representatives, workers in these industries need to learn about the changes that could affect their livelihoods. Government. policy and regulatory bodies will use this scientific information to develop safety standards and regulations. Finally, medical associations and organizations concerned with cardiovascular and occupational health issues can relate this information to their members and constituents.

I. LSCHEMIC HEART DISEASE

SUMMARY

Ischemic heart disease or coronary heart disease (CHD) is considered the major potential cause of acute incapacitating illness in commercial motor vehicle drivers other than substance abuse and fatigue.

Coronary risk factors (CRF) should be defined in all interstate commercial drivers with professional union and industrial management support provided for early detection and preventive programs.

Ischemic heart disease may not be disqualifying if functional status suggests adequate reserves and low potential for dysrhythmia. Exercise tolerance testing is proposed as the main method for functional assessment of men over 45 years of age who manifest one or more CRF. It is not proposed to exercise test asymptomatic drivers without disease unless considered at "high risk" of developing disease by defined CRF criteria. Periodic individual evaluations are recommended, and a means for acquiring and analyzing disease and accident data throughout the industry are considered essential.

ISCHEMIC HEART DISEASE

Dr. Stephen Scheidt (Chairman)
Col. Jules Bedynek, M.D.
Dr. Robert A. Bruce
Mr. Harold B. Clark
Dr. Samuel M. Fox, III
Dr. Gerald Friedman
Dr. Joan Kishel
Dr. Paul L. McHenry
Dr. Roy Shephard

Ischemic heart disease is a major clinical problem in the United States, with an estimated 1.5 million acute myocardial infarctions yearly, over 4.5 million patients with angina, approximately 300,000 sudden cardiac deaths, nearly 200,000 coronary bypass procedures, and probably over 80,000 coronary angioplasties yearly. There are over 1 million Americans in the population who have had coronary bypass surgery. 1 There are no good statistics on the incidence of ischemic heart disease in the commercial motor vehicle industry; the incidence of overt coronary heart disease (CHD) is likely to be low in commercial driver6 because of their generally younger age than the general population and the screening process that occurs internally, with disease-induced inability to meet the often rigorous demands of commercial driving, and externally, because of the medical certification process now in place. However, significant coronary artery disease certainly occurs without any clinical symptoms whatever--various estimate6 place the prevalence risk of significant asymptomatic coronary atherosclerosis at between 2.5 and 6 percent of the middle-aged male population of the United States. It is thus clear that substantial numbers of people with overt or occult coronary disease will be found within the motor carrier industry, and guidelines are needed to minimize the potential risk from ischemic heart disease to the general public as well as to commercial drivers themselves.

There is, however, little firm evidence that ischemic heart disease plays a role in many commerical motor vehicle accidents. Unfortunately, U.S. data are almost nonexistent on medical, causes of commercial motor vehicle accidents. Data from the Canadian province of Ontario suggest relatively low accident rates per vehicle-mile in the motor carrier industry, with relatively few accidents clearly related. to medical problems, and relatively small risk that CHD will cause immediate incapacitation on the highway. Thus, only a small proportion of commercial motor vehicleassociated fatalities might be prevented by finding, treating, or excluding commercial drivers with ischemic: heart disease. 3 Further, there is little evidence, anecdotal or otherwise, that substantial numbers of accidents are related to sudden cardiac death or other rapid incapacitation due to ischemic heart disease in U.S. commercial drivers. In addition, there is apparently little possibility of obtaining firm data on this subject because records of commercial motor vehicle accidents are not collected in a manner that permits easy

analysis of potential or actual medical problems (see recommendations for future research). It was well recognized by the Task Force that the overwhelming majority of patients with ischemic heart disease lead active and productive lives in other occupations and that many take part in strenuous work-related activities, rehabilitative programs, and sporting activities with generally low complication rates. Thus, the general consensus of the Task Force is that the mere presence of ischemic heart disease is not necessarily grounds for disqualification for driving, even granting the admittedly heavy work load of some jobs in the motor carrier industry. Given recent advances in selection of individuals at "high risk" for complications of ischemic heart disease, advances in rehabilitation and therapy, and lack of evidence that many highway accidents are related to ischemic heart disease, the Task Force proposes the guidelines listed below for medical certification of commercial drivers.

Drivers Without Known Ischemic Heart Disease

The Task Force recommended continuation of current certification every 2 years. There was some belief that, at least for ischemlc heart disease, certification could be done much less often for drivers under age 40, perhaps no more than every 4 to 6 years. 'However, it should be recognized that promotion of "wellness" and detection, counseling, or treatment of potential risk factors for ischemic disease might be enhanced by recertification every 2 years. At the time of certification, the physician's examination should include the following:

1. Family history:

   - History of myocardial infarction or sudden death before age 60 in parents or siblings.

2. Personal history:

   - History of smoking, diabetes, hypertension, hyperlipidemia (serum cholesterol > 250 mg/dl).

3. Past medical history and symptom review:

   - Chest discomfort with or without exertion or other episodic upper body exertional discomfort that might be an angina1 equivalent.
   - Significant shortness of breath (i.e., inability to walk at least 2 blocks or climb a flight of stairs).
   - Recurrent and/or severe palpitations.
   - Severe dizziness or fainting.
   - Leg or calf pain with walking 2 blocks or climbing a flight of stairs.

4. Physical examination:

- Height, weight, blood pressure, pulse.
- Observation of neck veins.
- Examination of carotid arteries for bruits.
- Chest and lung examination.
- Heart examination:

  --Point of maximal impulse or left border of cardiac dullness (for diagnosis of cardiac enlargement).
  --Rhythm.
  --Heart sounds and gallops.
  --Heart murmurs.

- Abdominal examination for abdominal aortic aneurysm.
- Palpation of dorsalis pedis and posterior tibia1 pulses.

5. Electrocardiogram:

- After age 40, every third biennial physical examination.
- After age 55, every 2 years.

There was a near consensus within the Task Force that an electrocardiogram would be useful when a person first enters the trucking industry, at whatever age (certainly if entry is after age 40). Given the substantial mobility of drivers, a copy of the electrocardiogram should be given to the driver so that it would be always available as a baseline.

6. Chest. x-ray: No agreement.

7. Blood tests: Serum cholesterol and blood sugar tests, preferably fasting. These tests should be done at. entry into the industry and at every third biennial examination thereafter. (These tests are intended for estimation of CHD risk.)

8. Exercise stress testing: Whenever a suspicion of coronary insuff i-ciency , signif icant dysrhythmia, or unexplained symptomatology of a possibly hazardous type is elicited, including possible angina or angina1 equivalents (epigastric, shoulder, arm, jaw, etc. discomfort that is closely related Lo exertion and disappears shortly after cessation of exertion).

The pros and cons of routine exercise testing of asymptomatic middle-aged populations are under active discussion. There is a substantial potential for "false positive" responses that require expensive further

study, and the Task Force did not recommend routine exercise tolerance testing for the general driving population under 45 years of age. However, after age 45, the incidence of CHD rises substantially, and stress tests, when used in conjunction with standard coronary risk factors obtained from other assessments (clinical evaluation, abnormal resting electrocardiogram, blood tests), are able to select groups that may have an incidence of coronary events as high as or higher than groups with known clinical coronary disease. Although unanimity was not reached, some members of the Task Force did favor special attention to commercial drivers believed to be at "very high risk" for coronary artery disease. Suggested criteria for "high risk" in the asymptomatic population include:*

a. Family history of CHD under age 60.

b. Smoking over one pack of cigarettes a day.

c. Serum cholesterol > 250 mg/dl.

d. Blood pressure > 180 mm Hg systolic or 105 mm Hg diastolic. (Some members of the Task Force would prefer consistently elevated pressure > 140 mm Hg systolic and/or > 90 mm Hg/diastolic.)

e. Glucose intolerance: causal blood sugar > 105 mg/dl, causal (nonfasting) > 120 mg/dl, and/or definite! glycosuria.

f. Obesity (40 percent over ideal weight; ideal weight may be calculated as
wt = -60.7 kg. 9 0.79 (height in cm) in men
-65.2 kg. + 0.79 (height in cm) in women.

Suggestions for action include more frequent certifying examinations, perhaps yearly until risk factors are reduced, and requiring exercise tolerance tests as part of the biennial physical examination in asymptomatic individuals with two or more of the above-listed risk factors.

Appendix A gives data on the expected incidence of primary CHD events given various clinical risk factors and exercise test findings, based on two epidemiological studies.4'7

Using data from the Seattle Heart Watch study of 4,105 healthy men without clinical history, symptoms, and signs of coronary artery disease, appendix A provides yearly incidence rates for any CHD event in previously healthy asymptomatic men and also for sudden cardiac incapacitation, which is obviously of greater relevance to accident causation. Sudden cardiac death does unfortunately occur at all ages, with an annual incidence of 0.1-0.2 percent in the middle age range from 40-54 years; the incidence triples after age 54. The sudden deaths are not Particularly concentrated among those with multiple conventional risk

*The threshold values listed as cutpoints are not necessarily considered "normal" values.

factors, but adding an exercise test allows far better prognostication, with an alarmingly high incidence of sudden cardiac incapacitation (> 8 percent yearly!) among those very few older men vith at least one conventional risk factor and two or more abnormal exercise test findings (not just "ischemic" ST segment depression alone, as can be seen from the last analysis of appendix A). Thus, one suggested strategy would be not to do exercise tests on those without any conventional risk factors (over 40 percent of the Seattle population) and on those with risk factors but who are under age 40 (another 15 percent). This method of selection of men, being more conservative about requiring exercise testing, might still identify by exercise many (but not all) of those who will later experience sudden death. It is particularly important to obtain exercise tests on men over age 54 with at least one conventional risk factor.

Drivers With Myocardial Infarction

General medical practice in the United States in 1986 is to allow the majority of patients who have recovered from acute myocardial infarction to return to work, including medium but not hard work (i.e., exercise capacity of 7 to 9 METS) so long as patients are asymptomatic and have certain characteristics on noninvasive testing. The cardiologic literature provides numerous original articles and reviews concerning prognostic stratification of postmyocardial infarction patients. In general, patients without ischemia as determined by good exercise tolerance, no angina, and no electrocardiographic manifestations of ischemia on exercise testing have a very favorable prognosis even in the early stages after infarction.[8-9] It must be recognized that the mortality after myocardial infarction is much higher in the first year after infarction than thereafter, particularly in the first 3 to 6 months after the infarction. However, in several studies[10-13] summarized by DeBusk et a1.,13 mortality in patients with good exercise tolerance and negative exercise tests soon after infarction was as low as 2 to 4 percent in the first postmyocardial infarction year. The Task Force recommended the following criteria for certifying individuals post-infarction:

At 3 Months After Infarction

1. Examination by cardiologist.

2. Asymptomatic.

3. Exercise tolerance test negative for ischemia at reasonable work load. (See below.)

The general principles underlying the interpretation of the exercise test are that the work load obtained be consonant with the expected work load of the individual's job and that there be a lack of significant ischemia as manifested by clinical symptoms, dysrhythmia, ST segment change, inadequate blood pressure response, or other findings during exercise. Although exercise testing must be individualized,

suggested guidelines for commercial drivers with "heavy" job stress (see appendix B) include completion of 8 to 10 METS of exercise: (through Bruce Stage III or equivalent) and achievement of 'heart rate > 85 percent of predicted maximum for age. Systolic blood pressure should-rise by 40 or more mm Hg without more than 10 mm Hg increase in diastolic pressure. For commercial drivers with less than "heavy" job stress, somewhat lower exercise test performance may be allowed (i.e., completion of stage II of Bruce protocol), but with more frequent followup.

It is recognized that many patients may be on beta blockers after infarction. Although the best prognostic data has been obtained and it thus appears advantageous if patients can be off beta blockers for the test, achievement of exercise intensity adequate for the expected job stress is acceptable if discontinuing beta blockers is considered inadvisable in individual patients.

It is suggested that individuals who return to work from 3 to 6 months postmyocardial infarction, a period in which mortality is still somewhat higher than after the &-month mark, be temporarily shifted to less than "heavy" stress jobs, if at all possible.

Twenty-four-hour ambulatory "Holter" monitoring, radionuclide studies (thallium exercise tests and/or gated wall motion studies), and coronary angiography should all be done as clinically indicated but are not believed necessary as a condition for certification in a patient who successfully completes the standard exercise tolerance as given above.

At 1 Year Postmyocardial Infarction

Clinical evaluation by a cardiologist and exercise tolerance testing according to the criteria listed for initial certification at 3 to 6 months should be conducted.

Long-Term Followup Testing

Clinical followup by a cardiologist and exercise tolerance testing as described above should be conducted. Some experts on the Task Force believed that clinical and exercise testing followup on a yearly basis indefinitely would be ideal, but the cost implications of this were recognized; a compromise might be careful clinical followup annually and exercise testing according to the above criteria every 2 years. After age 55, clinical followup and exercise testing according to the above criteria should be done every year in a patient with a 'history of myocardial infarction.

Drivers With Angina Pectoris

Certification of individuals with known angina pectoris is predicated on the knowledge that the clinical outlook for patients with mild to moderate angina is good. In the medically treated group of the Coronary Artery Surgery Study (CASS), overall mortality was 1.4 percent

a year, and only 1.0 percent a year in patients with ejection fractions greater than 50 percent.[14] It is presumed that commercial motor vehicle drivers who are able to continue to hold a job will have no more than mild to moderate angina similar to CASS patients.

Criteria for certification should include the following:

1. Examination by a cardiologist.

2. No change in angina pattern within 3 months of examination.

3. Normal resting electrocardiogram.

4. Exercise tolerance test response that shows exercise capacity consonant with the expected job stress and that is generally negative for ischemia (as described for the patient after myocardial infarction). In the commercial driver with "heavy" job stress, this would generally mean exercise of 8 to 10 METS, through Bruce Stage III or equivalent and/or attaining heart rate greater than 85 percent of predicted maximum, rise in systolic blood pressure $\geq$ 40 mm Hg without angina or significant ST segment depression.

5. No symptomatic (light-headedness) resting blood pressure on physical examination less than 95 mm Hg systolic.

6. No systolic decline of blood pressure > 20 mm Hg on standing. (These latter two criteria are added because many patients with angina may be taking antianginal medications, and hypotension or orthostatic hypotension is sometimes a side effect of such medications.)

Drivers After Coronary Artery Bypass Surgery

Many patients with coronary artery bypass surgery return to work within 2 to 3 months after the operation; heavy upper body (exercise that might be required of commercial motor vehicle drivers could have adverse effects on wound healing, so return to work is not recommended before 3 months. The exact timing of testing and suggested return to work will be individualized. The criteria listed below apply to patients without myocardial infarction 6 months before surgery or during the perioperative period.

Exercise testing to determine ability to return to work is the same as described above for patients with myocardial infarction: there should be exercise capacity consonant with the individual's expected job requirements and the lack of significant demonstrated ischemia, either by exercise testing or other methods. Suggested criteria for exercise testing will vary somewhat, but in patients with "heavy" job stress, these will include exercise of 8 to 10 METS (through Bruce Stage III or equivalent), achieving a heart rate greater than 85 percent of predicted maximum for age, and rise in systolic blood pressure $\geq$ 40 mm Hg.

Radionuclide exercise testing (thallium perfusion scan or stress wall motion study) is indicated if:

1. The patient cannot achieve the levels given above on a standard exercise treadmill test. Dysrhythmia on treadmill testing would also be reason to proceed to radionuclide testing; the purpose of this or other sophisticated testing is to exclude significant myocardial ischemia if certification for driving is allowed.

2. "Heavy" job stress is expected before 6 months after operation (see appendix B).

Coronary arteriography is suggested only if clinically indicated.

Patients who have had coronary bypass surgery should have clinical followup once a year indefinitely and should be asymptomatic. Exercise testing according to the criteria above should be performed evety 2 years indefinitely. Late coronary artetiography is not required. However, considerable sentiment was expressed by the conference participants for more frequent and perhaps more intensive followup late after bypass surgery because of the well-known risk of late graft occlusion or progression of native coronary artery disease with time. Given some estimates of a 5 percent rate of graft occlusion per year 5 years or more after bypass surgery, 13 late followup might include yearly exercise testing beginning 6 to 10 years after surgery.

A recent report from the CASS registry selected a group of post-coronary bypass patients with characteristics presumed similar to airline pilots seeking medical certification after surgery.[16] Thus, the 2,326 members of the "simulated aviator" population were under age 60; male; without prior coronary bypass surgery, congestive heart failure (CHF), stroke, cancer, diabetes, enlarged heart on chest x-ray, or moderately elevated blood pressure (systolic > 200 mm Hg or diastolic > 100 mm Hg) preoperatively; without perioperative myocardial infarction; and without hospitalization for chest pain, CHF, dysrhythmia, or stroke within 12 months postoperatively. Among 2,326 patients fitting these criteria, survival rates over 5 years were calculated; in the subgroup without previous myocardial infarction, survival was better than that of an age-matched U.S. population; in those with prior myocardial infarction and relatively well preserved left ventricular function, survival was similar to the general U.S. male population; and among those with prior myocardial infarction and moderate to severe left ventricular dysfunction, there was a small but significant decrease in survival compared to the general population.

Acute cardiac events, defined as acute coronary insufficiency, myocardial infarction, or sudden death, were similar for all subgroups; about 90-94 percent of men were free of such events over the 5-year followup with an average annual risk of 1.6 percent per year in those without prior myocardial infarction. In the nonsmokers without prior myocardial infarction and hypertension, 98 percent were event free over 5 years, with an annual acute event rate of 0.4 percent per year.

This study is of interest, but there are some caveals tor our purposes: first, events in this CASS study were not all immediately incapacitating, and a commercial driver might easily stop his or her vehicle safely even if acute myocardial infarction or acute coronary insufficiency occurred. Second, syncope was not included among CASS events and its incidence is unknown. Third, "simulated aviators" may not be comparable to real working commercial. motor vehicle drivers, and stresses on the latter, both physical and psychological, may be considerably greater than in CASS registry patients. Finally, Hammond[17] reported followup data on 234 real airmen who were approved for active flight status after coronary bypass surgery, and the event rate seemed considerably higher than in the CASS report,. although events were defined much more broadly and some, such as adverse change in ECG or abnormal exercise tolerance test, would not be acutely dangerous. Survival in the Hammond group was slightly lower than in the CASS group.

Taken together, these data support the proposition that many patients should be able to return to driving after coronary bypass surgery and that acute cardiac incapacitation rates are quite low, particularly if those with myocardial infarction or left ventricular dysfunction (and perhaps also smoking!) are excluded.

Drivers After Percutaneous Transluminal Coronary Angioplasty

Although percutaneous transluminal coronary angioplasty (PTCA) causes much less immediate morbidity than bypass surgery and there is no problem with healing of a surgical wound, patients having undergone PTCA need more intensive followup because there is a sublstantial rate of reocclusion that may reach 20 to 30 percent within the first 6 months after angioplasty.[18] Thus, criteria for certification after PTCA are similar to those for certification after coronary bypass surgery except for the following:

1. Initial exercise testing and possible return to work may occur from 3 weeks to 6 months after PTCA.

2. During the period from 3 weeks to 6 months post-PTCA, the need for more intensive scrutiny will often imply that drivers should work at jobs with less than "heavy" stress whenever possible.

3. Retesting by exercise tolerance testing according to the criteria listed for coronary bypass surgery should be done 3 to 6 months post-PTCA.

Because the long-term course of PTCA is not as well delineated as that of postbypass surgery patients, clinical and exercise testing followup according to the above criteria should be done yearly indefinitely.

Administrative Recommendations

1. The Task Force is strongly in favor of strengthening the process of certification, by training and certification of physician examiners.

2. Centralization of medical records would clearly be desirable to provide longitudinal followup data not only on overt disease, but particularly on risk factors. If this is not feasible, other possibilities for assuring longitudinal data availability should be explored, perhaps requiring motor carriers or even drivers themselves to keep and make available such data over time.

Research Recommendations

1. Data are urgently needed on the frequency of incidents and accidents in commercial motor vehicles that might be attributed to ischemic heart disease. Further investigation of Fatal Accident Reporting System (FARS) records, or perhaps of state records currently available, might provide such data

2. Data are needed on the incidence of recognized coronary risk factors and of coronary heart disease in commercial motor vehicle drivers to provide some estimate of the potential benefits from risk reduction or "wellness" programs. The Task Force believed strongly that major benefits to commercial drivers themselves are likely in terms of future reductions in morbidity, mortality, and job loss from ischemic heart disease. Additional possible benefits to highway safety are difficult to quantify until data noted under #1 above are available.

Probably the greatest long-term effect on highway safety would come from risk factor detection and reduction, with consequent prevention of ischemic heart disease and lengthening of drivers' productive careers. Although no firm predictions are possible because of the lack of data, it was the impression of Task Force members that coronary risk factors among commercial drivers are probably much higher than in the general population of similar age, particulary because of smoking, poor dietary selection, and sedentary lifestyle. Guides to risk factor incidence might be available from records of certain large carriers that have detailed accounting on large numbers of truck drivers. Pilot programs of screening asymptomatic commercial drivers by exercise testing, similar to the screening programs of the U.S. Army,[7] might establish the prevalence of occult coronary heart disease among commercial drivers and, if high, would provide a powerful incentive for aggressive efforts on the part of industry, unions, and particularly commercial drivers themselves (but probably not the Federal Government) to accelerate reduction of both risk factors and thus the future incidence of ischemic heart disease and its complications.

Summary of Certification Requirements Relating to Ischemic Heart Disease

No Known Ischemic Heart Disease

1. Clinical examination every 2 years with more complete history/physical
2. Electrocardiogram at age 40, then every third biennial examination until age 55, then every 2 years
3. Blood cholesterol and glucose levels at entry to industry and at every third biennial examination
4. Exercise tolerance test if above age 45 and 2 or more specified coronary risk factors

After Myocardial Infarction

1. Initial certification:
   a. At least 3 months postinfarction
   b. Examination by cardiologist
   c. Asymptomatic
   d. Negative exercise test through Bruce Stage III, 8 to 10 METS, and 85 percent of maximum heart rate predicted for age
   e. Suggested less than "heavy" job stress until 6 monthlhs post-infarction
2. Followup:
   a. Clinical evaluation by cardiologist
   b. Asymptomatic
   c. Negative exercise test as above at 1 year postinfarction, then every 2 years until age 55, then yearly

With Angina Pectoris

1. Evaluation by a cardiologist
2. Mild or moderate angina
3. No unstable angina within 3 months
4. Normal resting electrocardiogram

5. Negative exercise test through Bruce Stage III, 8 to 10 METS and ≥ 85 percent of maximum heart rate predicted for age

6. No symptomatic resting systolic blood pressure < 95 mm Hg

7. No decline of blood pressure 20 mm Hg on standing

After Coronary Artery Bypass Surgery

1. Initial certification

   a. At least 3 months postsurgery

   b. No myocardial infarction within 6 months before surgery or during perioperative period

   c. Evaluation by cardiologist

   d. Negative exercise test through Bruce Stage III, 8 to 10 METS, ≥ 85 percent of maximum heart rate predicted for age

   e. Suggested less than "heavy" job stress until 6 months post-surgery

2. Followup

   a. Clinical evaluation by cardiologist yearly

   b. Negative exercise test to Stage III, etc., every 2 years; yearly beginning 6 to 10 years after surgery

After Percutaneous Transluminal Coronary Angioplasty (PTCA)

1. Initial certification

   a. At least 3 weeks post-PTCA

   b. Evaluation by cardiologist

   c. Asymptomatic

   d. Negative exercise test through Bruce Stage III, 8 to 10 METS, ≥ 85 percent of maximum heart rate predicted for age

   e. Suggested less than "heavy" job stress until 6 months post-PTCA

2. Followup

   1. Clinical evaluation and negative exercise test as above

      3 to 6 months post-PTCA and yearly indefinitely

Incidence of Primary Coronary Heart Disease Events and Sudden Cardiac Incapacitation According to Age, Risk Factors, and Results of Exercise Testing in 4,105 Healthy Seattle Men (A)[5] and 916 Indiana State Troopers. 6

1971-1981

		Annual Incidence of Any CHD		Annual Incidence of "Sudden Cardiac Incapacitation" (B)	
		number events/ total subjects	(%/year)	number events	(%/year)
A.I.	Healthy asymptomatic Seattle men				
	< age 40	7/1,186	(0.11)	1	(0.02)
	40-49	3311,672	(0.35)	15	(0.16)
	50-54	13/689	(0.33)	8	(0.20)
	> 54	28/558	(1.07)	17	(0.65)
II.	Healthy asymptomatic men with conventional risk factor assessment but without exercise testing (C)				
	0 risk factors	21/1,791	(0.22)	2	(0.002)
	1	45/1,739	(0.47)	8	(0.08)
	2	13/521	(0.46)	2	(0.0'7)
	3	4/51	(1.31)	-	
	4	0/3		-	
III.	Healthy asymptomatic men with conventional risk factor(s) and exercise stress testing assessment (D)				
1.	"Low risk" (no conventional risk factors) < age 40	l/576	(0.04)	O	
	40-49	8/707	(0.20)	O	-
	50-54	4/279	(0.25)	1	(0.06)
	> 54	8/230	(0.75)	1	(0.09)
2.	"Moderate risk" (> 1 clinical, but < 2 exercise risk factors) < 40	6/605	(0.18)	O	
	40-49	25/959	(0.45)	4	(0.07)
	50-54	7/396	(0.30)	1	(0.04)
	> 54	14/309	(0.94)	2	(0.13)
3.	"High risk'" (> 1 clinical and > 2 exercise risk Factors) < 40	0/5	-- Q< .001	0	- Q < .001
	40-49	O/6	--	0	
	50-54	4/14	(0.62)	0	
	> 54	19/19	(9.72)	5	(8.10)

IV. Disregarding conventional risk assessments, and relying upon maximal exercise testing of all subjects.

		Any CHD, events/n	(%/yr)	Sudden Incapacitation events	(% yr)
1.	Attained > Bruce Stage III on ETT,				
	a. ≥ 85% max HR, no isch ST depression	>lmm53/3,125	(0.31)	3	0.017
	b. yes " " "	7/248	(0.47)	3	0.203
	c. < 85% " " no " " "	0/44		0	
	d. yes " " "	0/1		0	
2.	Attained Bruce Stage III				
	a. ≥ 85% max HR, no isch ST depression	11/518	(0.40)	2	(0.01)
	b. yes " " "	3/55	(1.18)	2	(0.79)
	c. < 85% " " no " " "	2/65	(0.79)	0	
	d. Yes " " "	4/9	(12.21)	1	(3.05)
3.	Attained < Bruce Stage III				
	a. ≥ 85% max HR, no isch ST depression	2/16	(2.72)	0	
	b. yes " " "	1/4	(6.45)	1	(6.45)
	c. < 85% " " no " " "	0/15		0	
	d. yes " " "	0/5		0	
4.	All stages exercise (disregarding duration of exercise)				
	a. ≥ 85% max HR, no isch ST depression	61/3,585	(0.31)	5	(0.03)
	b. yes " " "	16/389	(0.70)	6	(0.26)
	c. < 85% " " no " " "	2/115	(0.42)	0	
	d. yes " " "	4/16	(6.74)	1	(1.69)
5.	a. Any maximum HR, no isch ST depression	63/3,699	(0.32)	5	(0.03)
	b. yes " " "	20/406	(0.85)	7	(0.30)

From McHenry,6 916 healthy Indiana State Troopers, Balke maximal symptom limited stress test:

		Coronary Events
Any abnormal ST response (E)	21/61 = 34.4%/12.7 yrs	1 = 1.6%/12.7 yrs
Normal ST response	44/833 = 5.3%/12.7 yrs.	7 = 0.8%/12.7 yrs.

Appendix A

Notes:

(A) Appendix A primarily from Seattle Heart Watch and Network Registry data; unpublished data, Bruce RA, 1987.

(B) "Sudden cardiac incapacitation" defined as sudden cardiac death within one hour of onset of symptoms and/or sudden cardiac arrest with subsequent resuscitotion by ventricular defibrillation (only 5.9 percent were resuscitated).

(C) Assessment of middle-aged men without exercize testing (as per Bruce RA et al: Value of maximal exercise tests in risk assessment of primary coronary heart disease in healthy men. Am J Cardiol 1980;46: 371-8):5

"No risk factors" = none of clinical risk factors (family history of myocardial infarction or sudden death in parents or siblings under 70 years of age; smoking; systolic BP > 140 mm Hg; serum cholesterol > 250 mg/dl)

"1 or 2 risk factors" = only 1 or 2 of above clinical risk factors

"3 or 4 risk factors" = only 3 or 4 of above clinical risk factors

(D) Assessment in men after any exercise testin& (as per Bruce RA et al., Am J Cardiol, ibid.):'

"Low risk" = no clinical risk factors

"Moderate risk" = 1 or more clinical risk factors, < 2 exercise risk factors (chest pain during exercise, maximal heart rate < 90 percent of maximum predicted for age, ischemic ST depression > 1 mm horizontal or downsloping persisting at least 1 minute into recovery or If upsloping persisting at least 3 minutes into recovery; short exercise duration, < Bruce Stage III, i.e., < 6 minutes of ‹ Bruce Stage III.

"High risk'" = 1 or more clinical rlsk factors, and 2 exercise risk factors

(E) From McHenry et a1.6 "Abnormal ST response" = > 1 mm horizontal or downsloping ST segment depression during or after exercise without labile ST-T changes during standing or hyperventilation. (Balke symptom limited protocol in 916 healthy subjects aged 27-55 years.)

CHD = Coronary heart disease

Appendix B

Definition of "Heavy" Job Stress in Truck Drivers

Definition: “Heavy” job stress in the commercial motor carrier industry includes extensive driving and on-duty time such as 8 to 10 hours behind the wheel; major involvement in freight handling such as loading and unloading trucks; pickup and delivery of freight with multiple stops; works with load securement devices, i.e., securing various types of loads and materials with tarpaulins, chain binders, and cables.

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ISCHEMIC HEART DISEASE TASK FORCE MEMBERS

Dr. Stephen Scheidt
Chairman
Division of Cardiology
The New York Hospital-Cornell
Medical Center
525 East 68th Street
New York, New York 10021

Col. Jules Bedynek, M.D.
Office of the Surgeon General
HQDA (DASG-PSF)
5111 Leesbutg Pike, Room 608
Falls Church, Virginia 22041-3258

Dr. Robert A. Bruce
Division of Cardiology
University Hospital
University of Washington
School of Medicine
Mail Stop RG 22
Seattle, Washington 98195

Harold B. Clark
Director of Safety
Thurston Motor Lines, Inc.
600 Johnson Road
Charlotte, North Carolina 28206

Dr. Samuel M. Fox III
Georgetown University School of
Medicine
3800 Reservoir Road, N.W.
Washington, D.C. 20007

Dr. Gerald Friedman
Clinical Professor of Medicine
Mount Sinai School of Medicine
New York City, New York
and
Corporate Medical Director
United Parcel Service
51 Weaver Street, Building 5
Greenwich, Connecticut 06830

Dr. Joan Kishel
Department of Pathology
Uniformed Services University
of the Health Sciences
4301 Jones Bridge Road
Bethesda, Maryland 20814

Dr. Paul L. McHenry
Division of Cardiology
Indiana University Medical Center
Indianapolis, Indiana 46202

Dr. Roy Shephard
Faculty of Medicine
Department of Preventive Medicine
and Biostatistics
University of Toronto
School of Physical and Health Education
Toronto, Ontario M5SlAl
CANADA

ISCHEMIC HEART DISEASE
INDUSTRY AND MEDICAL REPRESENTATIVES

Mr. Harold Clark
Director of Safety
Thurston Motor Lines, Inc.
600 Johnson Road
Charlotte, North Carolina 28206

Mr. Neil Darmstadter
Senior Safety Engineer
American Trucking Association
2200 Mill Road
Alexandria, Virginia 22314

Mr. R.V. Durham (Ischemic Heart Disease)
International Brotherhood of Teamsters
25 Louisiana Avenue, N.W.
Washington, D.C. 20001

Dr. John W. Eberhard
National Highway Traffic Safety
Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Mr. Joe Frith (Ischemic Heart Disease)
Overnite Transportation Company
P.O. Box 1216
Richmond, Virginia 23209

Mr. William Johns (Ischemic Heart Disease)
American Trucking Association
2200 Mill Road
Alexandria, Virginia 22314

John Turner
Giant Food Stores
Box 1804
Washington, D.C. 20013

II. HYPERTENSION AND PERIPHERAL VASCULAR DISEASE

SUMMARY

With modern therapeutic capabilities most commercial motor vehicle drivers with hypertension should be able to continue driving. Hypertension predisposes individuals to target organ damage particularly cerebral and coronary compromise, which requires continued effective blood pressure control and frequent evaluation for evidence of significant impending impairment. Therapy must not compromise mental alertness nor the ability to respond appropriately to environmental changes i.n temperature and both psychologic and physical challenges. Peripheral vascular disease of the limbs can be disabling, but modern therapy often can restore adequate function.

Effective preventive programs, supported by all concerned, should reduce mortality, morbidity, and early forced retirement in a highly cost-effective manner.

KYPERTENSION AND PERIPHERAL VASCULAR DISEASE

Harris M. Kenner, M.D. (Chairman)
Charles L. Curry, M.D.
J. Caulie Gunnels, M.D.
Mark A. Johnson
William J. Mroczek, M.D.

Hypertension

Hypertension alone is unlikely to cause sudden collapse; however, the likelihood increases when target organ damage, particularly cerebral vascular disease, is present. Most commercial drivers with hypertension are not immediately unqualified to operate a commercial motor vehicle in interstate commerce. The following interim regulatory criteria are based on the conference's recommendations, which used the report of the 1984 Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure as its starting point.

Initial blood pressure of 161-180 systolic and/or 91-104 diastolic is considered mild hypertension, and the driver need not be found unqualified during evaluation and institution of treatment. The driver is given a 3-month period to reduce his or her blood pressure to less than or equal to 160/90; the certifying physician should state on the medical certificate that it is only valid for that 3-month period. If the driver is subsequently found qualified with a blood pressure less than or equal to 160/90, the certifying physician may issue a medical certificate for a l-year period but must confirm blood pressure control in the third month of this l-year period. The individual should be certified annually thereafter. The expiration data must be stated on the medical certificate.

Initial blood pressure of greater than 180 systolic and/or greater than 104 diastolic is considered moderate to severe. The driver may not be qualified, even temporarily, until his or her blood pressure has been reduced to less than 181/105. The examining physician may temporarily certify the individual once the individual's blood pressure is below 181 and/or 105. For initial blood pressure greater than 180 and/or 104, documentation of continued control should be made every 6 months. The individual should be certified biannually thereafter. 'The expiration date must be stated on the medical certificate.

The initial blood pressure finding should be confirmed by at least two subsequent measurements on different days. Blood pressure measurement should be made with the subject seated comfortably and relaxed. Systolic and diastolic pressures should be recorded, with the diastolic pressure reported as the disappearance of sound (phase V). Upper arm constrictuion by a rolled sleeve should be avoided. Large-sized cuffs should be available for use in subjects whose arm girth is larger than **normal** .

Evaluation of the hypertensive commercial driver should consist of a search for additional risk factors and evidence of target organ damage. Inquiry should be made regarding smoking, cardiovascular disease in relatives, and immoderate use of alcohol. An electrocardiogram (ECG) and blood profile, including glucose, cholesterol, HDL cholesterol, creatinine and potassium, should be made. An echocardiogram and chest x-ray are desirable in subjects with moderate or severe hypertension.

Since the presence of target organ damage increases the risk of sudden collapse, group 3 or 4 hypertensive retinopathy, left ventricular hypertrophy not otherwise explained (echocardiographic or ECG by Estes criteria), evidence of severely reduced left ventricular function, or serum creatinine of greater than 2.5 warrants the driver being found unqualified LO operate a commercial ❑ oLor vehicle in interstate commerce.

Treatment includes nonpharmacologic and pharmacologic modalities as outlined by the Joint National Committee, as well as counseling Lo reduce other risk factors. Most antihypertensive medications also have side effects, the importance of which must be judged on an individual basis. Side effects of somnolence or syncope are particularly undesirable in commercial drivers. Commercial drivers should be informed of the side effects of drug therapy and the interaction of their drugs with other prescription drugs, nonprescription drugs, and alcohol.

A commercial driver who has normal blood pressure 3 or more months after a successful operation for pheochromocytomas primary aldosteronism (unless bilateral adrenalectomy has been performed), renovascular disease, or unilateral renal parenchymal disease and who shows no evidence of target organ damage should be qualified. If residual hypertension is present and can be controlled with acceptable drugs and there is no target organ disease, the driver should be qualified on the same basis as those with essential hypertension.

Surgically Corrected Hypertension

A commercial driver who has normal blood pressure 3 or more months after a successful operation for pheochromocytoma, primary aldosteronism (unless bilateral adrenalectomy has been performed), renovascular disease, or unilateral renal parenchymal disease and who shows no evidence of target organ damage should be qualified. If residual hypertension is present and can be controlled with acceptable drugs and there is no target organ disease, the driver should be qualified on the same basis as for those with essential hypertension.

Peripheral Vascular Disease

Arterial Disease

Evidence of peripheral arterial disease, including occlusive disease, aneurysm, or embolism, should result in further evaluation for associated cerebrovascular or coronary artery disease.

Intermittent claudication, the most common presenting manifestation of occlusive arterial disease, need not be disqualifying if the individual is able to walk several blocks without pain. Spontaneous (rest) pain is disqualifying because of the likelihood of reduced dexterity of the affected limb.

Successful revascularization resulting in relief of symptoms for at least 3 months may allow qualification for return to driving if the commercial driver has not taken anticoagulants for at least 1 month. Aneurysm of any size in any vessel is disqualifying because of the unpredictable timing of onset of rupture or thromboembolism with associated cardiovascular collapse. Surgical correction may allow qualification 3 months after surgery.

Evidence of systemic embolism is disqualifying. Identification and correction of the source of the embolus may result in qualification if the driver has been free of embolic phenomena for at least 3 months and has not taken anticoagulants for at least 1 month.

Venous Disease

Deep venous thrombosis is disqualifying because of the risk of pulmonary embolism with sudden incapacitation or death. Varicose veins and superficial thrombophlebitis are not disqualifying because the risk of embolus formation in these conditions is low. Effective therapy with evidence &hat the commercial driver has been free of deep venous thrombosis for at least 3 months and has not taken anticoagulants for at least 1 month may result in qualification.

Pulmonary Embolism

Pulmonary embolism is disqualifying because of the risk of sudden collapse or death. Effective treatment with evidence that the commercial driver has been free of pulmonary embolism for 6 months and has not. taken anticoagulants for at least 1 month may result in qualification.

Anticoagulant Therapy

Treatment with warfarin or its derivatives or heparin may be complicated by hemorrhage and resulting collapse and is disqualifying.

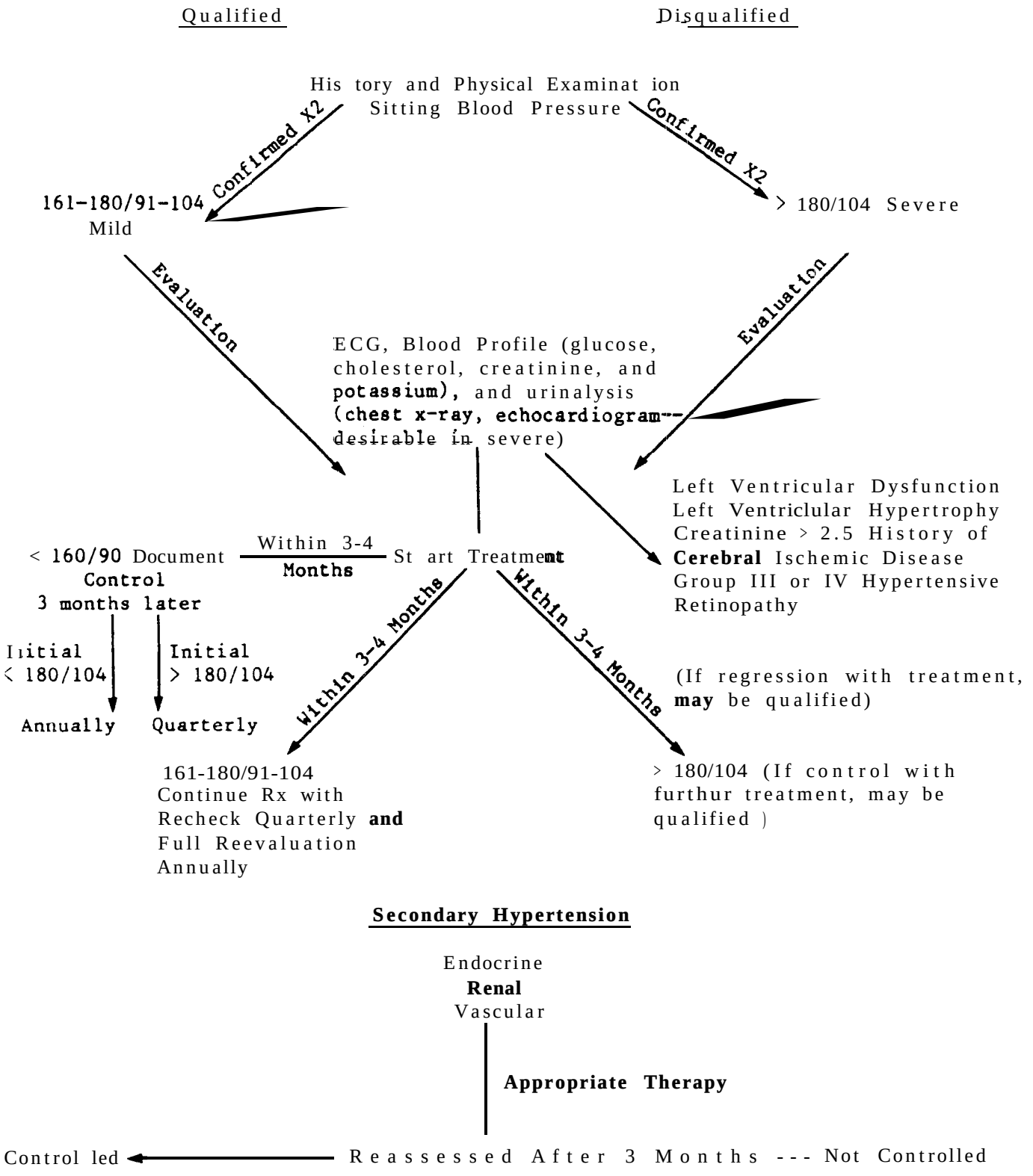
Remarks

Reducing the risk of cardiovascular collapse in commercial drivers is a realistic goal and may be expected to enhance highway safety. Demanding that all drivers be disease free is unrealistic and may result in falsification of dara or inappropriate denial of symptoms.

Reduction of risk factors and prevention or control of illness will benefit both the driver and the carrier by enhancing the driver's quality of life and on-the-job performance. Commercial drivers should therefore be encouraged to seek professional advice and treatment for those areas identified to be in need by their qualifying examination.

The history and physical form is insufficient and outdated and requires immediate revision. A copy of the completed form should be submitted to a governmental body. This would be likely to improve the quality of the examination.

Certification of examining physicians by the Department of Trans-. portation is probably unrealistic, but commercial drivers should be encouraged to have their examinations done by physicians certified by an organized body such as the American Board of Family Practice, and the American Board of Internal Medicine.



Secondary Hypertension

Endocrine
Renal
Vascular

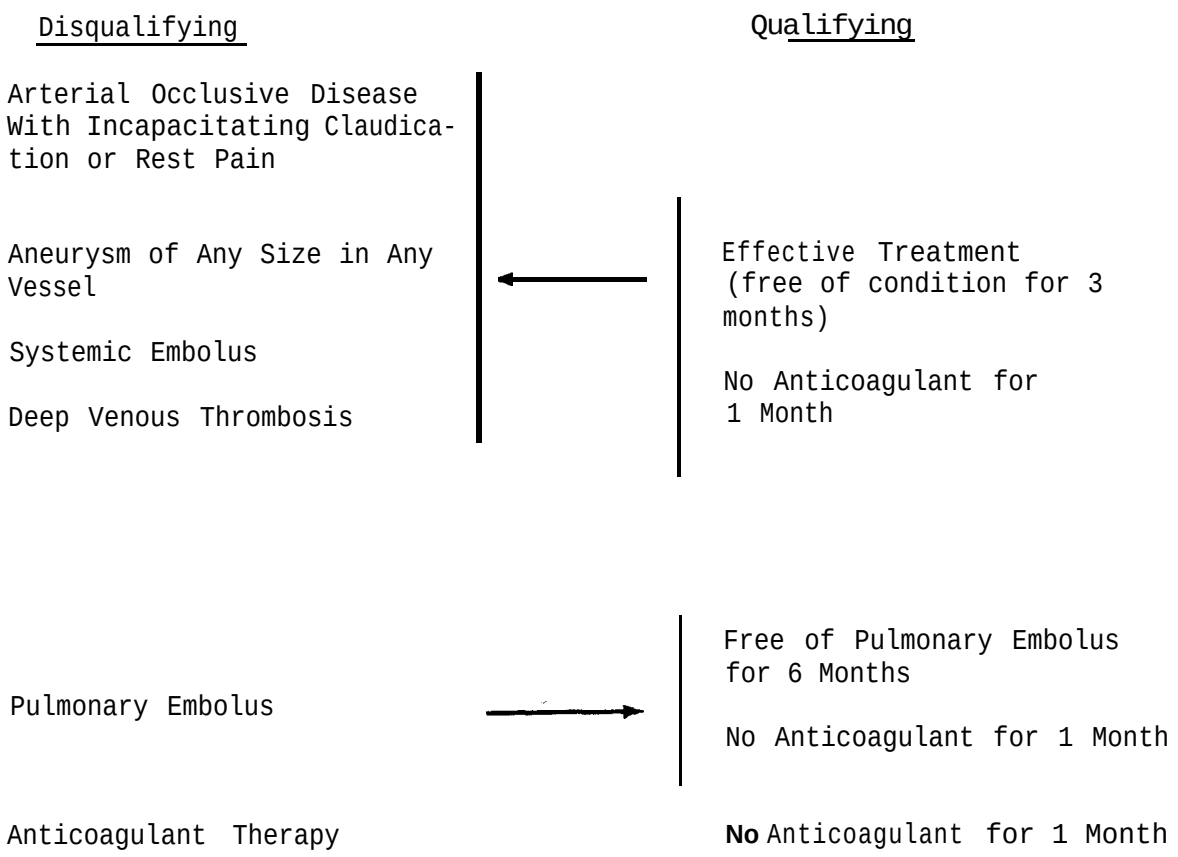
Appropriate Therapy

Reassessed After 3 Months --- Not Controlled ⟵ Controlled

Coronary risk factors should be evaluated and corrected where possible. Positive family history, cigarette smoking, obesity, diabetes mellitus, and elevated cholesterol.

Presence of multiple factors may influence mode of antihypertensive Rx.

Peripheral Vascular Disease



III. VALVULAR, MYOCARDIAL, F'ERICARDIAL, AND CONGENITAL HEART DLSEASE

SUMMARY

Commercial drivers with many of the above conditions can be certified if free of significant cardiac impairment and not prone to disabling cardiac dysrhythmias. Surgical correction of many abnormalities has returned patients to normal or near normal function with documentation often not requiring invasive (heart catheterization) followup. Echo-Doppler studies, exercise tolerance testing, and ambulatory monitoring have provided adequate data in many cases. Some prosthetic materials are acceptable, but need for anticoagulation is considered disqualifying. Frequent followup is advisable and in some cases mandatory.

VALVULAR, MYOCARDIAL, PERICARDIAL, AND CONGENITAL HEART DISEASE

Dr. Charles Hufnagel (Chairman)
Dr. Kent Bailey
Dr. Jeffrey Borer
Dr. William Roberts
Dr. David H. Spodick

General Principles

With the changes in evaluative modalities and therapeutic options that have occurred during the 16 years since guidelines were last developed, it has become apparent that appropriate and equitable evaluation of patients with known or suspected cardiac problems requires the skills of the cardiovascular diseases specialist. Therefore, a primary premise of these guidelines is that, when an initial medical evaluation of a commercial motor vehicle driver by any physician provides evidence suggestive of even moderate likelihood of cardiac disease, further evaluation should be performed by a board-certified cardiovascular disease specialist.

Since the utility of any evaluative system depends in part on recognition of individuals potentially at risk, criteria for referral of commercial drivers to cardiovascular disease specialists have been made relatively broad.

We hope the design criteria outlined here will be of high predictive value for potentially important cardiac problems. However, available data suggest that cardiac-related accidents and fatalities are very uncommon. We believe, therefore, that it is more important that these criteria do not inappropriately or unfairly preclude workers from qualification.

It is understood that, in recent years, we have gained considerable understanding of the natural history of untreated and treated valvular, myopericarditic, cardiomyopathic, and adult congenital diseases. Moreover, we have developed considerable information on how various objective descriptors relate to natural history.

These guidelines reflect this new information while they attempt to minimize the information-gathering and testing procedures necessary to establish qualification or disqualification for certification.

1. Evidence of potential problem requiring referral to cardiovascular specialist (any of the following).

   a) History:

      - Acute rheumatic fever-history of murmur

      a Chest pain without obvious non-cardiac cause

- Typical symptoms of congestive heart failure (orthopnea, paroxysmal nocturnal dyspnea, dyspnea on exertion, shortness of breath at rest) or prior history of pulmonary edema
- Presyncope/syncope without obvious non-cardiac cause
- Known congenital heart disease
- Current use of cardioactive drugs
- Systemic disorder known to be closely associated with potentially clinically important cardiac problems
- Prior cardiac surgery
- Other history of known cardiac illness

b) Physical exam findings:

- Any murmur (see below)
- Any other physical finding (visual, palpable, or auditory) believed by the examining physician to be potentially associated with heart disease (e.g., neck veins, carotids, or precordial impulses of abromal amplitude or wave form, thrills, abnormalities of Liming of second heart sound components)
- Adventitious sounds (e.g., clicks, rubs, filling sounds)

C) ECG:

- Abnormal QRS voltage (high or low)
- Pathologic prolongation of P wave or other evidence of left atria1 abnormality (deep biphasic P wave in V_1 lead)
- Abnormal QRS deformity or duration
- ST-T abnormalities other than early repolarization
- Any conduction abnormality
- Any rhythm disturbance (atria1 or ventricular)

Items a) and b) above would be part. of intake evaluation for all drivers. Item c) should be required routinely al. intake for candidates age > 35 years.

2. Criteria for the use of the cardiovascular specialist.

a) To qualify without objective tests:

- Absence of symptoms

plus

- Absence of murmur
  or
  Presence of systolic murmur
  - ≤ grade II/VI
  - that does not vary with prompt squatting standing from squat, or Valsalva maneuver,

plus

- Absence of neck vein, carotid, or precordial pulse abnormality,

plus

- Absence of abnormal timing of second heart sound components or adventitious sounds (e.g., clicks, tubs, filling sounds) ,

plus

- Absence of ECG abnormalities noted above.

b) To disqualify without objective test:

- Clear congestive heart failure symptoms (orthopnea or paroxysmal nocturnal dyspnea), irrespective of cause

or

- Current use of anticoagulant.8 (warfarin or heparin type) or of other unacceptable cardioactive drug (see drug subcommittee)

c) If above criteria are not met,, It is presumed that the commercial driver may have valvular, myopericarditic, cardiomyopathic, or congenital disease (type suggested by clinical evaluation). Regardless of specif ic clinical findings, such drivers must go on to objective testing which, at the outset, probably should involve echocardiography (H-mode, 2D, and Doppler), and which may involve radionuclide-based assessment and/or rhythm analysis as noted below.

If any doubt exists regarding accuracy or interpretation of echocardiography results, cardiac catheterization may be necessary.

3. Disqualification criteria.

General disqualification: Chronic atria1 fibrillation or recurrent atria1 fibrillation > three times.

A. Valvular heart disease:

1) Aortic Stenosis (AS)

a) Echo-Doppler peak gradient < 20 mm Hg
and cath peak-to-peak gradient < 20 mm Hg
→ No AS disqualification

b) Echo gradient > 50
or cath gradient > 40
→ AS disqualification regardless of symptoms

c) Echo gradient 20-50 mm
or cath gradient < 20-40 mm

and

angina, atypical chest pain, presyncope or snycope

ot

Exercise treadmill test with any of the following:

- < 30 mm rise of systolic BP,
- repetitive ventricular premature beats, or
- symptoms lead to cessation of test at < Bruce Stage III

then AS disqualification.

2) Pure Aortic Regurgitation (AR) (no element of Aortic Stenoeis)

(a) Typical skeletal features of the Marfan syndrome or aortic toot > 45 mm dimension by M-mode echo-cardiography.

(b) In patients with hemodynamically important AR even in absence of congestive heart failure symptoms. Hemodynamically important AR is defined as

- physical signs including early diastolic blowing murmur, plus
- Doppler echocardiography ≥ 3+/4+ AR

or

Doppler < 3+ but physical examination findings consistent with aortic regurgitation plus left ventricular dimension > upper limit of normal

or

echocardiography unclear, cardiac catheterization evidence of > 3+ AR.

(NE: these are primary exclusion criteria.)

--Left ventricular ejection fraction subnormal at rest or

--Left ventricular fractional shortening subnormal at rest or

--Less than Srage III Bruce protocol

3) Mitral stenosis (MS)--in asymptomatic'patient (NB: congestive failure, and chronic atria1 fibrillation = disqualification) echocardiographic evidence of:

(a) Mitral valve area < 2 cm^2 by 2 D echocardiography or

(b) History > 3 episodes of atria1 fibrillation if atrial fibrillation not chronic or

(c) Left atria1 size > 45 mg with any MS by echocardriography or

(d) Less than **Bruce** S&age **III** without other **obvious cause** for exercise intolerance, with any MS.

Catheterization can **be elected** *and* patient requalified if **mild** (> 2 cm2) MS confirmed and with exercise to symptom-**limited** end point, pulmonary artery **wedge** pressure ≤ 15mm Hg.

4) Pure mitral regurgitation (MR)--hemodynamically important (defined as Doppler echocardiography ≥ 3+ MR, or, if Doppler echocardiography < 3+ MR, left ventricular internal dimension > upper limit of normal and/or left arterial dimension > upper limit of normal, or cardiac catheterization **documented** ≥ 3+ MR)

PLUS

(a) ***New*** York Heart Association functional class $\geq$ II by symptoms or

(b) Less than Bruce Stage III exercise tolerance or

(c) Subnormal left ventricular fractional shorteaing (echocardiography) or left ventricular ejection fraction (radionuclide ventriculogram), and/or subnormal right ventricular ejection fraction (radionuclide ventriculogram) or pulmonary artery pressure > 35 mm Hg in ***systole*** by Doppler.

(d) Left atria1 dimension > 45 mm.

(e) Ruptured chordae tendinea by echocardiography.

(f) Pulmonary artery systolic pressure by catheter > 35 mm Hg or pulmonary artery diastolic pressure > 25 mm Hg (rest).

(g) Ventricular tachycardia ($\geq$ 3 sequential beats or perhaps, frequent couplets) by 24 hour electrocardiogram by itself may be sufficient to warrant disqualification with > 3+ MR.

(h) Presence of severe tricuspid valve disease by Doppler, or any tricuspid regurgitation by physical exam or cath.

5) Combined MS/MR - any of criteria (3) and any of criteria (4).

6) Combined MS ($\pm$MR) + AS ($\pm$ AR) or pure MR and pure AR - any of criteria (1), (2), (4), or (5).

7) Mitral valve prolapse--criteria (5) or criteria for primary rhythm abnormality as per dysrhythmia subcommittee.

8) Tricuspid regurgitation-presence of this entity by physical examination or by cardiac catheterization, or presence of severe tricuspid regurgitation by Doppler echocardiology.

9) Post-valve repair, dilatation or replacement.

(a) Disqualification criteria for any of the non-operated valve diseases If present postoperative (except for performance criteria).

(b) Mechanical valve in any position.

(c) Tissue valve in mitral or tricuspid position (NE: any chronic warfarin/heparin anticoagulant is reason for exclusion).

(d) Requalification at a minimum of 3 months since operation.

(e) Valve repair (not replacement) which leaves residual abnormalities meeting preoperative exclusions (including need for anticoagulant treatment).

B) Cardiomyopathy:

If asymptomatic, disqualify if

1) Hypertensive type

(a) Evidence of obstruction by echocardiography or cardiac catheterization.

(b) If without obstruction.

- Left aerial dimension > 45 mm (NB: congestive symptoms are disqualifying).

- If patient has angina/atypical chest pain; other evidence of absence of coronary artery disease (normal radionuclide ventriculogram with exercise or cardiac catheterization).

(NB: congestive symptoms disqualify, dysrhythmias disqualify as per dysrhythmia subcommittee, angina disqualifies).

2) Dilated type (defined as subnormal Left ventricular ejection fraction and/or enlarged left ventricular internal dimension)

(a) Left ventricular ejection fraction or left ventricular fractional shortening is subnormal or > upper limit of normal as sole abnormality (this disqualification can be reversed if echocardiography and/or radionucllde ventriculogram findings are unchanged 6 months after initial. finding, and no other criteria [below] are met).

(b) Subnormal left ventricular ejection fraction or (< 50 percent) left ventricular fractional shortening or abnormal. Left ventricular internal dimension plus evidence of intrachamber clot by 2 D echocardiography.

(c) Subnormal left ventricular ejection fraction or (> 50 percent) left ventricular fractional shortening or abnormal left ventricular internal dimension plus biopsy evidence of active inflammatory process.

3) Restrictive type--(defined as normal or modestly subnormal Left ventricular ejection fraction/left ventricular fractional shortening, normal. Left ventricular internal dimension, echocardiography evidence of subnormal diastolic performance and , usually, abnormal left ventricular wall thickening)---if sole abnormal finding and patient asymptomatic, suspend for 3 months. Lack of progression can be reason for requalification. Left atria1 dimension > 45 mm.

Acute Myopericarditis

Probably every significant attack of pericarditis includes an element of myocardial involvement (with the exception of uremic pericarditis). Although pericarditis per se does not provoke significant dysrhythmias its symptoms are distracting and often debilitating, and it may be a part of a systemic disease. In cases which are dominantly myocarditlc and in "pure" myocarditls, the latter are also true and there may be dysrhythmias and cardiogenic embolism. In both acute pericarditis and myocarditis, patients should be completely disqualified from commercial driving until recovery is complete and without significant sequelae.

Fundamental tests: electrocardiogram, echocardiogram, complete blood count, blood cultures and serology with particular reference to viral etiologies, chest x-ray.

Medical history and risk factors: the type of onset, antecedent disease, either systemic or acute (especially in the respiratory and gastrointestinal systems).

Followup testing: repeat any original tests that were abnormal.

Chronic Pericardial Disease

This pertains to (a) cardiac constriction, with or without an element of chronic cardiac tamponade and (b) cardiac tamponade without constriction and (c) recurrent acute pericarditis. The latter often requires antiinflammatory therapy; if it is adequately suppressed, it probably does not disqualify drivers. Chronic cimpressive disorders of the pericardium (disqualify--unless surgically remediated) require surgical therapy; otherwise they belong in a category comparable to congestive heart failure.

Congenital Heart Disease

Introduction

The following recommendations for applicants for medical certification as commercial motor vehicle drivers are based on what is known about the natural history of congenital heart disease and about the long-term followup of postoperative patients. Regrettably, there are few specific data available about the risk of sudden death or incapacitation. During the past 30 years, both early and Late mortality results of surgery for congenital heart disease have steadily improved. The older a person is at the time of surgical correction, the greater the chance of a late complication. This has been demonstrated for coarctation of the aorta, tetralogy of Fallot, and atria1 septal defect. It is difficult to make categorical judgments regarding the suitability of individuals for driver certification who have had congenital heart disease or who have had surgical correction of a cardiac defect. IT is hoped that applicants suspected of having congenital cardiovascular disease will be identified and evaluated before entry into driver training. Recertification of drivers with congenital heart disease will depend upon serial evaluation of existing residua.

Diagnostic Evaluation

The presence of congenital heart disease should not automatically disqualify applicants as medically unfit for commercial driver certification This decision should be based on the specific anatomic diagnosis and its severity and whether the condition has or has not been treated surgically. The decision for certification should consider the applicant's present status and the possibility of Late onset of functional derangements or impairment. When initial screening suggests the presence of a congenital cardiac anomaly, the applicant should be referred for further cardiac evaluation The definitive diagnosis of the condition and its severity should be established by an expert in congenital heart disease. This evaluation should use appropriate noninvasive and invasive techniques.

The following noninvasive studies should be carried out in every applicant suspected of having congenital heart disease: (1) a complete history and physical examination, (2) a 12-lead electrocardiogram, (3) a chest radiograph, and (4) an echocardiogram. In those people considered at risk for the development of dysrhythmia, continuous electrocardiographic monitoring at rest and during exercise should be carried out. Exercise tolerance testing is useful in most cases of significant congenital heart disease. Individuals who have had open heart surgery should have exercise testing to evaluate cardiac function and to elicit cardiac rhythm disturbances. Intracardiac electrophysio-Logic studies may be necessary to evaluate certain conditions properly. In selected cases, hemodynamic studies with contrast visualization should be performed.

Recommendations

Applicants for certification are likely to be those with mild forms of congenital heart disease for whom surgery is not indicated or in whom the condition has spontaneously resolved, for example, spontaneous closure of a ventricular septal defect. Also, those persons w'ho have had surgical repair of a malformation may apply for commercial driver certification. Persons with more significant congenital heart disease are not likely to apply for a job as a driver. Persons with uncorrected cyanotic congenital heart disease should not be certified.

The presence of an isolated, small, left-to-right shunt, defined as a pulmonary-to-systemic flow ratio of less than 1.5.:1, should not disqualify an individual for certification, whether this shunt is at the atria1 or ventricular level. Such individuals should have normal electrocardiograms, normal heart size on chest radiograph, and no evidence of increased pulmonary artery pressure. Risk of a sudden incapacitating event due to the presence of such an isolated heart defect is almost nonexistent.

In general, the presence of prosthetic devices such as right ventricle to pulmonary artery conduits or artificial valves are considered disqualifying because of the substantial risk of complications Prosthetic material per se is not disqualifying. For example, many persons with coarctation of the aorta have a repair with Dacron patch grafts. Surgical closure of a ventricular septal defect usually includes a material patch. In both instances, the results of surgery, not the presence of a prosthetic material, should determine eligibility for driving status.

Criteria for evaluating applicants with the following common congenital cardiovascular anomalies should serve as guidelines for assessing all forms of congenital heart disease. For postoperative applicants, a minimal waiting period of 6 months following surgery is recommended to permit clinical and hemodynamic evaluation of results.

Aortic Valvular Stenosis

Individuals with a minimally stenotic aortic valve, including a bicuspid aortic valve, may be certified if they are asymptomatic, have a systolic murmur of grade 3/6 or less, and have no left ventricular hypertrophy on physical examination, on electrocardiogram, on echocardiogram, or on chest radiograph. A graded submaximal treadmill exercise test should be normal (to 90 percent of maximal heart rate or symptom limited, reached with a normal heart rate response and normal exercise tolerance for the individual's age). If these studies are equivocal, cardiac catheterization should be performed. The pressure difference between the left ventricle and aorta should be < 30 mm Hg under conditions of normal cardiac output, and left ventricular end diastolic pressure should be < 12 mm Hg. Persons who meet these criteria have no increased risk of sudden death or incapacitation. Progression of the stenosis with age is common, and it has been estimated that 20

percent of individua.ls with minimal aortic stenosis will develop aortic valve calcium by age 45 years. Therefore, annual cardiovascular examinations by a specialist would be necessary for renewal of the certificate.

A pressure difference across the aortic valve between 30 and 50 mm Hg under conditions of normal cardiac output is considered to be moderate aortic stenosis. Although the risk of sudden death or incapacity is not great, a small percentage of such persons do die suddenly without previous symptoms. CMV drivers may be certified if they meet the following criteria: (1) auscultation should demonstrate a typical systolic murmur and an aortic ejection click; (2) the resting electrocardiogram should show neither left ventricular hypertrophy nor ST segment or T wave changes; (3) the chest radiograph should demonstrate a normal heart size but may show poststenotic dilatation of the ascending aorta and mild left ventricular contour to the heart shape; (4) echocardiography should show normal left ventricular function; (5) the near maximal graded treadmill exercise test should be normal, demonstrating neither significant cardiac rhythm disturbances nor ST segment changes, and the predicted heart rate response and level of exercise should be within normal limits for the individual's age; (6) cardiac catheterization should demonstrate a pressure difference between 30 and 50 mm Hg across the aortic valve. Doppler echocardiography may be acceptable to quantify the pressure difference provided the examination is done by a physician who is expert in echo-Doppler diagnosis. If inconsistencies exist between the Doppler findings and other clinical data, catheterization should be done. An annual cardiovascular examination by a specialist would be necessary for renewal of certificate. If clinical change is noted, repeat cardiac catheterization or echo-Doppler study would be indicated.

Moderate to severe aortic valve stenosis is defined as a pressure difference across the aortic valve > 50 mm Hg with normal cardiac output. Persons with this disorder would not qualify for certification because of the recognized risk of sudden death or incapacity and because of the recognized risk of progression of the lesion.

Although the results of aortic valvotomy are good, with an operative mortality of approximately 2 percent, long-term prognocsis remains guarded. Postoperative sequelae such as recurrent obstruction, aortic regurgitation, infective endocarditis, and late sudden death may affect as many as 50 percent of such individuals. Therefore, individuals who have been operated upon for aortic valve stenosis ordinarily would not be certified, although they may be certified 6 months after aortic valvotomy if they meet the criteria for a minimally stenotic valve as defined above. In .addition, they must not have more than trivial aortic regurgitation.

Subvalvular Aortic Stenosis

This is defined as discrete, membranous subaortlc left ventricular outflow obstruction without associated valvular abnormalities or hypertrophic cardiomyopathy. Such individuals may be certified if the

obstruction is trivial as defined by lack of symptoms, a normal. chest radiograph and electrocardiogram, no more than trivial aortic regurgitation, and a pressure difference across the left ventricular outflow tract of < 20 mm Hg with a normal cardiac output. Following surgical correction, individuals ordinarily would not be certified again because of significant late complications. Commercial drivers may be certified if 6 months after surgery they are asymptomatic, have a normal chest radiograph and electrocardiogram, normal exercise electrocardiogram, no more than trivial aortic regurgitation, and a pressure difference across the left ventricular outflow tract of < 20 mm Hg, with a normal cardiac output.

Discrete Supravalvular Aortic Stenosis

Few data exist for this defect. The decision for certification should be in keeping with recommendations for valvular and subvalvular aortic stenosis. Persons with uncorrected supravalvular aortic stenosis would not qualify. After surgical correction, individuals may qualify for certification if they meet the criteria described for persons following correction of subvalvular aortic stenosis.

Atrial Septal Defect

Persons with either an ostium secundum or sinus venosus atrial septal defect may be qualified for certification if they are asymptomatic and have cardiac catheterization findings of normal pulmonary artery pressure, a pulmonary-to-systemic flow ratio of < 1.5:1, and no right-to-left shunt. Such individuals have no increased risk of sudden death or incapacitation. Persons who have had surgical correction of one of these two types of atria1 septal defect may be qualified for certification if they are asymptomatic, have normal physical findings, no cardiac: rhythm disturbance other than respiratory sinus dysrhythmia, or occasional. atria1 or ventricular premature complexes, minimal residual chest radiograph or electrocardiograph findings, and no evidence of residual defect by echocardiography. Such individuals have an excellent prognosis with little evidence to suggest subsequent cardiac deterioration.

Persons with an ostium primum atria1 septal defect may be certified if they are asymptomatic and have cardiac catheterization findings of normal pulmonary artery pressure, pulmonary-to-systemic flow of < 1.5:1, and no more than trivial mitral regurgitation Some caution should be exercised with this group, however, because the degree of mitral regurgitation can increase with age, and conduction system disorders may occur. Annual cardiovascular examinations by a cardiologist would be necessary for renewal of the certificate. Following surgical correction, such individuals may be certified if they are asymptomatic, have no cardiac rhythm distrbance other than respiratory sinus dysrhythmia or occasional atrial or ventricular premature complexes, minimal residual radiographic or electrocardiogram findings such as the expected left anterior hemiblock pattern, and have postoperative cardiac catheteriza tion demonstration of normal pulmonary artery pressure, no significant

residual left-to-right shunt (pulmonary-to-systemic flow ratio < 1.2:1), and no more than trivial mitral regurgitation by angiography or by quantitative noninvasive evaluation. Individuals with a greater degree of mitral regurgitation following surgical correction can qualify for < "heavy" stress jobs if they meet the criteria just described. For all such persons, annual cardiovascular examinations by a cardiologist would be necessary for renewal of the certificate.

Aortic Isthmic Coarctation

Persons with uncorrected coarctation of the aorta have a significantly shortened life expectancy, with an average age at death of 35 years. Because of the presence of systemic hypertension, these individuals are at risk to develop its complications, including intracranial hemorrhage, aortic rupture, and congestive heart failure. They may qualify for certification if they are asymptomatic, have a normal electrocardiogram, have normal blood pressure at rest without medication, and have < 10 mm Hg resting peak systolic pressure difference between the arms and legs. They should also have normal treadmill exercise tests, including a normal blood pressure response. Persons with a bicuspid aortic valve must meet the criteria described for this lesion. Because each of these lesions can be progressive, an annual cardiovascular examination by a cardiologist is necessary for renewal of the certificate.

Individuals whose coarctation has been corrected surgically may qualify for certification if they are asymptomatic, have normal blood pressure and a < 10 mm Hg systolic pressure difference across the coarctation repair, a normal heart size on chest radiograph, normal resting and exercise electrocardiograms, and a normal blood pressure response to exercise. Persons with residual systemic hypertension would not qualify because of the significant risk of complications, including sudden incapacitation. If an abnormal aortic valve is present, criteria must be met for this lesion also. Some data suggest that surgical repair of coarctation of the aorta after the age of 12 years is associated with a subsequent risk of sudden death or cerebral vascular accident; indivduals in this group should be evaluated carefully and certified cautiously.

Patent Ductus Arteriosus

Persons with an uncorrected patent ductus arteriosus can qualify for certification if they are asymptomatic, have a normal chest radiograph and electrocardiogram, and have normal left ventricular size and function on echocardiogram. These individuals have no increased risk of sudden incapacitation. Persons whose ductus has been closed by surgery may be certified if the results of the physical examination, electrocardiogram, and chest radiograph are normal.

Pulmonic Valvular Stenosis

Individuals with this lesion may qualify for certification if the obstruction is trivial as defined by the absence of symptoms: the

presence of a grade 3/6 or less systolic ejection murmur at the left base ; a systolic ejection click that varies with respiration; minimal widening of the second sound with normal intensity of the pulmonic component; a normal electrocardiogram; a normal heart size on chest radiograph, with prominence of the pulmonic trunk; and echocardiographic criteria consistent with < 30 mm Hg pressure difference across the pulmonic valve. If the clinical assessment of the applicant is unclear, cardiac catheterization is necessary to document a pressure difference of < 30 mm Hg across the pulmonic valve in the presence of normal cardiac output. Such individuals are not at risk of sudden incapacitation.

Certification for drivers with less than "heavy" job stress may be considered for individuals with mild pulmonic valve stenosis as defined by physical examination findings of minimal pulmonic valve stenosis as just described and normal arterial oxygen tension, mild right ventricular hypertrophy on electrocardiogram and echocardiogram, and cardiac catheterization findings that demonstrate a pressure difference between 20-50 mm Hg across the pulmonic valve in the presence of normal cardiac output.

Moderate to severe pulmonic valve stenosis is defined as a pressure difference across the pulmonic valve > 50 mm Hg, with normal cardiac output. Individuals with this disorder would not qualify for certification because of the likely presence of right ventricular dysfunction and the likelihood of progression of the obstruction.

Persons who have had surgical or nonsurgical pulmonic valvotomy may be certified if they ***are*** asymptomatic, have a chest radiograph that shows only a prominence of the pulmonic trunk, an electrocardiogram that shows no more than mild right ventricular hypertrophy, an echocardiogram that shows no evidence of right ventricular dysfunction, and cardiac catheterization that demonstrates a pressure difference of < 30 mm Hg across the pulmonic valve in the presence of normal cardiac output. The presence of mild pulmonic valve regurgitation should not disqualify. Following valvotomy, drivers with less than "heavy" job stress may qualify if they meet these criteria but have a pressure difference across the pulmonic valve between 30-50 mm Hg in the presence of normal cardiac output.

Discrete Right Ventricular Infundibular Stenosis

Long-term followup data for this defect are few. The recommendations for valvular pulmonic stenosis shouid be followed in cases of discrete right ventricular infundibular stenosis. These persons may qualify for certification if the obstruction is mild as defined by the absence of symptoms, the presence of only minimal right ventricular hypertrophy on electrocardiogram, and a pressure difference of < 30 mm Hg across the outflow tract in the presence of normal cardiac output. A small ventricular septal defect may be present with a pulmonic-to-systemic flow ratio of < 1.5: 1 as long as the other criteria are met.

Individuals who have had surgical correction of discrete right ventricular outflow tract obstruction may be certified if they are

asymptomatic, have a normal heart size on chest radiograph, no more than minimal right ventricular hypertrophy and/or right ventricular conduction delay on electrocardiogram, a normal exercise electrocardiogram, and < 30 mm Hg pressure difference across the right ventricular outflow tract in the presence of normal cardiac output. A residual ventricular septal defect is allowable provided the pulmonic-to-systemic flow ratio is < 1.2: 1. Individuals exceeding these criteria may qualify for less than "heavy"' stress jobs if there is not > 30 mm Hg pressure difference across the right ventricular outflow tract in the presence of normal cardiac output, and if a ventricular septal defect is present, the pulmonic-to-systemic ratio must not exceed 1.5:1.

Supravalvular Pulmonic Stenosis, Including Coarctation of the Pulmonary Arteries

Persons may qualify for certification if the obstruction is trivial as defined above for trivial pulmonic valve stenosis. Following corre c-tion, certification may be given in accordance with criteria described for surgical correction of pulmonic valve stenosis.

Pulmonary Hypertension

Significant pulmonary hypertension from any cause is disqualifying. Persons with primary pulmonary hypertension are continually at risk of sudden death. Similarly, individuals with secondary pulmonary hypertension, such as those with Eisenmenger's syndrome, are also at risk of incapacitation and sudden death.

Tetralogy of Fallot

Few individuals with tetralogy of Fallot survive beyond the second decade of life without surgical intervention. Persons with uncorrected tetralogy of Fallot do not qualify. Following surgical correction, few individuals will be eligible for certification because of the significant Incidence of postoperative complications. However, an individual may be certified if the following criteria are met: transient third-degree heartblock must not have occurred in the postoperative period; there must be a normal heart size and normal pulmonary vascularity on chest radiograph and an absence of electrocardiographic evidence of bifascicular block, atrioventricular conduction delay, or dysrhythmia at rest or with exercise. Continuous ambulatory 24-hour electrocardiographic monitoring is required before certification and annually thereafter; treadmill exercise testing is also required annually. Echocardiographic documentation of normal right and left ventricular dimensions and function is required before certification and annually thereafter. It is also necessary to have documentation by cardiac catheterization of normal right ventricular function and dimensions, absence of more than trivial tricuspid valve regurgitation, right ventricular systolic pressure < 50 mm Hg in the presence of normal cardiac output, no right-to-left shunt, and no residual left-to-right shunt exceeding a pulmonary-to-systemic flow ratio of 1.2:1.

Individuals who have had surgical repair may qualify for less than "heavy" stress jobs if they meet the criteria just described but exceed cardiac catheterization requirements. However, the catheterization must document no more than minimal right ventricular dilatation, no more than mild tricuspid regurgitation, right ventricular systolic pressure < 50 mm Hg in the presence of normal cardiac output, no right-to-left shunt, and if a residual left-to-right shunt is present, It must not exceed a pulmonary-to-systemic flow ratio of 1.5:1. Because of the continuing risk of postoperative complications, annual cardiovascular examinations by a specialist are required for renewal of certification.

Simple Transposition of the Great Arteries (Without Associated Ventricular Septal Defect or Pulmonic Stenosis)

Because of the presence of substantial cyanosis, individuals with uncorrected transposition of the great arteries do not qualify. Persons who have undergone surgical correction of transposition of the great arteries do not qualify for "heavy" stress jobs because of the risk of postoperative complications. These Individuals may be considered for < "heavy" stress jobs if they are asymptomatic and are receiving no cardiac medication, have no more than mild cardiomegaly on chest radiograph, demonstrate sinus rhythm on routine electrocardiogram, an absence of significant cardiac dysrhythmia or significant conduction disturbance on 24-hour ambulatory electrocardiogram monitoring, and an absence of significant dysrhythmia on exercise testing. These indivduals must undergo postoperative cardiac catheterization with intracardiac electrophysiological studies that demonstrate no more than trivial tricuspid regurgitation, no right-to-left or left-to-right shunting, normal right ventricular dimensions with right ventricular end-diastolic pressure < 12 mm Hg, left ventricular systolic pressure < 50 mm Hg, normal sinus node function, and normal atrioventricular conduction. Because the long-term effects of the right ventricle's functioning as the systemic ventricle are not known, it is recommended that right ventricular performance be assessed periodically by appropriate techniques.

Ventricular Septal Defect

Persons with a small ventricular septal defect may qualify for certification. Such individuals must he asymptomatic, have typical ausculatory findings of a ventricular septal defect with normal splitting and intensity of the second sound, and no diastolic murmur of aortic regurgitation or increased mitral valve flow. They must have a normal heart size on chest radiograph, a normal electrocardiogram, and a normal left ventricular size and function by 2-dimensional echocardiography. Cardiac catheterization is not required, but if it is performed, it must document a normal pulmonary artery pressure, with a pulmonary-to-systemic flow ratio of < 1.5:1 and no right-to-left shunt. Persons with previous cardiac catheterization data that exceed these criteria, who undergo a spontaneous closure or clinically significant reduction in size of a ventricular septal defect, may qualify if they currently meet all of the other criteria described.

Individuals with a moderate size ventricular septal defect, that is, who exceed the criteria for a small ventricular septal defect, will not be certified. Although the risks of sudden incapacitation are not great, such events do occur. They may qualify for less than "heavy" stress jobs if they meet the following criteria: (1) they must be asymptomatic and be taking no cardiac medication; (2) they must have no more than mild cardiac enlargement on chest radiograph and no more than mild left atria1 enlargement and/or left ventricular hypertrophy on electrocardiogram, with no right ventricular hypertrophy; (3) there should be cardiac catheterization documentation of normal pulmonary arteriolar resistance, pulmonary artery systolic pressure < 50 mm Hg, and left-to-right shunt with a pulmonary-to-systemic flow ratio of < 2:1.

persons who have had surgical closure of a ventricular septal defect may be certified if they meet the following criteria: (1) they must be asymptomatic and taking no cardiac medication; (2) there must be no residual auscultatory evidence of a ventricular septal defect, and there must be normal splitting and intensity of the second heart sound; (3) there must be a normal heart size on chest radiography and a normal electrocardiogram at rest and with exercise. If a mild right ventricular conduction delay (QRS complex duration < 0.12 seconds) exists on the electrocardiogram, an individual may still qualify if no dysrhythmia occurs on 24-hour ambulatory electrocardiographic monitoring; this monitoring should be repeated annually. If a more significant right ventricular conduction delay is present, the individual may qualify if invasive His bundle studies show no prolongation of the H-V interval. Postoperative catheterization is not required if preoperative catheterization shows normal pulmonary arteriolar resistance.

IV. CARDIAC DYSRHYTHMIAS, SUDDEN DEATH, AND PACEMAKERS

SUMMARY

In these areas, diagnostic and therapeutic capabilities have advanced rapidly, but major concerns remain relative Lo sudden incapacitating events even with the best of both pharmacologic and instrumental approaches. Careful and extensive reviews of the clinical history and real-life or ambulatory ("Holter") type rhythm monitoring are Lhe initial approaches but "stress" testing and electrophysiologic studies of an invasive type (heart catheterization) may be needed LO justify providing a clearance for interstate truck driving. Debate continues concerning the ability to permit pacemaker-dependant persons LO qualify for commercial motor vehicle driving.

CARDIAC DYSRHYTHMIAS, SUDDEN DEATH, AND PACEMAKERS

William J. Oergen, M.D. (Chairman)
Doris J.W. Escher, M.D.
Donald L. Hanson
Larry K. Jackson, M.D.
Edwin E. Westura, M.D.
Ezekiel M. Wineglass

Introduction

Sudden death and incapacitation are the most dangerous manifestations of cardiac disease to the commercial motor driver and to the general public. It is therefore of prime importance that careful attention be given to the occurrence of cardiac rhythm disturbances in the medical evaluation of drivers.

This Task Force is cognizant of the fact that much of the initiative for a dysrhythmia workup originates from a history of cardiac irregularity, loss of consciousness, syncope, or some lesser form of central nervous or cardiovascular dyscrasia such as dizziness or "flashes." In the absence of an observed or evident incident, it is not self-serving for a commercial driver to provide such a history. Initial clinical workup, even if it includes an electrocardiogram or ambulatory monitoring, may miss pathology. The following, therefore, depends on the provision or accurate or leading information from the driver (spontaneous or elicited) or the coincidence of a positive finding on testing.

The medical history, physical examination, and electrocardiogram are the first means by which the diagnosis of cardiac dysrhythmias is made. The nature of the dysrhythmia may be readily apparent utilizing these methods, but supplemental studies may be necessary in order to precisely identify the clinical problem. These additional methods of study include ambulatory electrocardiographic monitoring, exercise electrocardiography, and invasive electrophysiologic testing. Evaluation of dysrhythmias utilizing the latter three modalities should be undertaken under the supervision of a qualified specialist trained in cardiovascular medicine.

When eliciting the medical history, careful attention should be paid to complaints of chest discomfort and palpitations, "skipped" beats, or "extra" beats. These symptoms may occur at rest or with exertion, and they may be associated with other symptoms such as dizziness, light-headedness or frank syncope.

Careful palpation of the cardiac impulse, peripheral pulses, and ausculiation of the heart sounds will often confirm the diagnosis of cardiac dysrhythmia; however, electrocardiographic confirmation is required to establish a specific rhythm abnormality. When there is a clinical suspicion of cardiac dysrhythmia to the examining physician, a 12-lead electrocardiogram should be performed and be a minimum requirement for the examination. A more prolonged "rhythm strip" may be reqarding.

Cardiac Dysrhythmias

Sinus rhythm is the dominant rhythm of the normal heart. It is characterized by the morphology of an atria1 depolarization wave which originates at the area of the sinus node and by the cardiac rate falling between 60 and 100 beats per minute. Sinus bradycardia (rates less than 60 per minute) and sinus Lachycardia (rates greater than 100 per minute) may be normal variants. When the patient is symptomatic from sinus bradycardia or sinus tachycardia, these may be considered abnormal rhythms, and a search for their cause is required. Sinus variation or dysrhythmia, spontaneous or with respiration--an associated variation in the regularity of sinus rhythm--is generally a normal variant and does not require further evaluation in the otherwise asymptomatic patient.. Commercial drivers with asymptomatic sinus dysrhythmia or sinus bradycardia or sinus Lachycardia in the absence of underlying relevant diseases should be considered fit Lo perform their duties.

Atria1 premature contractions are extremely common dysrhythmias. They may or may not cause symptoms in a patient, and in either case, they are generally benign. When symptomatic and disturbing Lo the patient, they may respond easily Lo simple treatment regimens such as cessation of cigarette smoking, modification of drinking habits or coffee consumption, or prescribed periods of rest. Rarely antidysrhythmic therapy will be required. Isolated asymptomatic or symptomatic atria1 premature contractions not requiring therapy should not be disqualifying for commercial drivers.

Atria1 fibrillation and atria1 flutter are more troublesome dysrhythmias. Although paroxysmal atrial fibrillation may well occur in otherwise normal hearts, the presence of atria1 flutter or sustained atria1 fibrillation. is more commonly associated with clinical disease. These dysrhythmias generally require specific therapy LO control the ventricular response rate, and they should preclude commercial driving until adequatel.y evaluated and treated. Multifocal atria1 tachycacdia is a cardiac dysrhythmia that is usually associated with serious underlying metabolic or pulmonary disease. Patients with this dysrhythmia should not be considered fit for driving operations.

Junctional Rhythms

(Cardiac dysrhythmias which originate in the atrioventricular junction are generally of two types: nonparoxysmal junctional Lachycardia and supraventricular Lachycardia of the AV nodal reentry type. Nonparoxysmal junctional tachycardia is an abnormality of the automatically function of cells in the atrioventricular junction region of the conduc-Lion system. Although this rhythm abnormality may rarely occur in an otherwise healthy heart, nonparoxysmal junctional tachycardia is generally an indication of cardiac disease of some significance. It is most common in the setting of digitalis toxicity. IL should require a careful evaluation for cardiac disease and should only be acceptable if the patient is asymptomatic and if other cardiac disease states are exc luded. Paroxysmal supraventricular Lachycardia occurs fairly commonly.

In general, it is not associated with major functional cardiac abnormalities or significant hemodynamic consequences. Patients who have these dysrhythmias and who are well controlled on any acceptable medical regimen and who are free from other structural or functional cardiac disease should be considered fit for commercial driving. Most of the common subtypes of this dysrhythmia involve conduction of a reentrant circuit through the atrioventricular node. A minority of these patients will have atrioventricular bypass tracts; some will have recognizable Wolff-Parkinson-White patterns on their surface electrocardiograms, and a few will be significantly symptomatic. Generally these subsets of paroxysmal supraventricular tachycardia are well coatrolled with medical therapy. A symptomatic subset will require detailed investigation LO determine mechanism and specific therapy for control. This subset of patients is not qualified for commercial motor vehicle operation.

Ventricular Dysrhythmia

Premature ventricular complexes are extremely common dysrhythmias which may be evaluated using the town Classification in analyzing the findings of twenty-four-hour ambulatory electrocardiographic recordings.

LOWN CLASSIFICATION

Grade	Characteristics
0	No premature ventricular complexes
1A	Occasional premature ventricular complexes, (less than 30 per hour and less than 1 per minute)
1B	Occasional premature ventricular complexes, (less than 30 per hour and greater than 1 per minute)
2	Frequent premature ventricular complexes, (greater than 30 per hour)
3	Multiform premature ventricular complexes
4A	Two premature ventricular complexes in a row
4B	Three or more premature ventricular complexes in a cow
5	R-on-T phenomenon

If premature ventricular complexes are encountered in the medical evaluation of commercial drivers, twenty-four-hour electrocardiographic

monitoring should be undertaken. Based on this study, asymptomatic Grades 1 and 2 dysrhythmias should not be disqualifying in the absence of other evidence of cardiac disease. Applicants with Grades 3 and above should be disqualified unless, on a case by case basis, they are cleared by a cardiologist after appropriate evaluation. Symptomatic or asymptomatic, sustained or nonsustained ventricular tachycardias are disqualifying for driving.

Heart Block

Measurement of the electrocardiographic PR interval and the atrio-ventricular conduction patterns permits the diagnosis of heart block. First degree atrioventricular block is defined as a PR interval greater than 0.2 seconds. It is commonly due to a delay in atrioventricular conduction. Second degree heart block implies intermittent failure of atrioventricular conduction, and it is seen as two patterns: Type I or Wenckebach conduction shows progressive prolongation of the PR interval until a QRS complex fails to occur and is followed by restoration of AV conduction with a shorter PR interval. Type II second degree heart block involves failure of atrioventricular conduction without previous progressive PR prolongation. In general, Type I block is under autonomic influence, occurs at the level of the AV node, and is a benign entity unless the resultant ventricular rate is symptomatically bradycardic. Type II block is less affected by autonomic tone, usually occurs in the His-Purkinje system below the level of the AV node, and is associated with more advanced conduction system disease. Third degree heart block is manifest by no conduction of electrical impulses from the atria to the ventricles.

First degree heart block and Type I second degree heart block should not contraindicate commercial driver certification unless symptomatic bradycardia is present. Second degree Type II and third degree heart block should be disqualifying because of the risks of sudden death or incapacitation.

Bundle branch blocks and fascicular blocks (hemiblocks) may occur as isolated electrocardiographic phenomena or as manifestations of underlying congenital, ischemic, or myopathic heart disease. These abnormalities should prompt a search for evidence of intrinsic cardiac abnormalities, but in the absence of such diseases they should not be, per se, disqualifying. It should be noted that in cases of left bundle branch block, because of the intrinsic aberration of the initial electro-cardiographic vectors, standard exercise ECG testing is of (extremely limited value. These patients should be subjected to exercise evaluation using radionuclide as well as electrographic techniques.

Pre-excitation syndromes may present as clinical tachydysrhythmias or as isolated asymptomatic findings on the electrocardiogram. Patients with symptomatic tachydysthythmias, uncontrolled by antidysthythmic medications, should be disqualified. Patients with dysrhythmias which are controlled by antidysrhythmic therapy for a period of six months should **be** qualified for six month periods, and semi-annual twenty-four

hour electrocardiograms should be performed to document their dysrhythmia-free status.

Sudden Death

Sudden cardiac death ("cardiac arrest") is an electrical phenomenon, frequently associated with a ventricular tachydysrhythmia and ischemic heart disease. Occasionally it may also be due to sinus arrest, complete heart block, and ventricular dysrhythmia. Although modern diagnostic and theraputic advances have improved the outlook of patients who have survived sudden cardiac death, they still carry a substantial risk of additional episodes. Any patient who has suffered sudden cardiac death and has survived should not be considered fit for commercial driving irrespective of the success of subsequent therapy.

Pacemakers

Currently, cardiac pacemakers are reliable instruments. However, special problems exist within this industry, and small numbers of individuals are involved; therefore, commercial drivers who are pacemaker-dependent should be regarded with special precautions. Pacemaker insertion should not per se be disqualifying for commercial drivers, but such patients should be followed carefully by a pacemaker center with &he latest. technological capabilities for diagnosing and treating dysrhythmias and pacemaker dysfunction.

A minority position among the task force members was: pacemaker implantation should be disqualifying because of the small number of patients involved, the lack of total certainty for pacemaker operation, and the high potential risks involved.

V. CARDIOVASCULAR PHARMACOLOGIC AGENTS

SUMMARY

Although therapeutic regimens can include a wide variety of pharmacologic agents without impairments contraindicating commerical motor vehicle driving, there are some agents that are particularly likely to compromise mental or cardiovascular capabilities. Clonidine, methyldopa, quanabenz, reserpice, and prazosin can either produce somnolence and/or impair reflex responses. Guanethidine is also likely to produce unacceptable orthostatic hypotension, causing inadequate cerebral blood flow. Most patients requiring amiodarone have conditions incompatible with commercial driving responsibilities, and many patients on anticoagulants have conditions of unacceptably high risk. Use of beta blockers is not a contraindication in itself, but careful individual evaluation is mandatory before recommending commercial driving responsibilities Frequent followup and documentation of individual functional capabilities is mandatory with many of today's therapeutic agents.

CARDIOVASCULAR PHARMACOLOGIC AGENTS

Donald F. Leon, M.D. (Chairman)
Bernard Bercu, M.D.
Donald Dawson, M.D.
Cecil R. Lee

Commercial motor vehicle drivers who require cardiovascular medications should be presumed to have significant heart disease or hypertension. Any decisions to permit or prohibit commercial vehicle operation by such drivers should be based on consideration of not only the specific medication required by such drivers but also the extent and severity of the individual's cardiovascular disease. To make fair and equitable determinations regarding safe performance capability, a complete clinical evaluation by a physician knowledgeable in the specifics of such diseases and medications is required. A detailed drug history must be recorded, including all cardiovascular and noncardiovascular medications, alcohol, and illicit drugs. Use of medications indicates the presence of an underlying medical condition or illness and calls for a thorough evaluation of the condition.

Determining safety criteria for commercial drivers receiving cardiovascular pharmacologic agents requires examination of the undesirable effects and side effects of such medications. Such effects may have an adverse influence on the safe performance of the driver. In general, those effects directly related to the central nervous system and those indirectly related to cerebral perfusion must be considered. These parameters include:

1. Production of somnolence.
2. Production of fatigue.
3. Impairment of judgment skills.
4. Impairment of reflexes.
5. Production of a variety of dyskinesias and other nervous system dysfunctions.
6. Inadequate blood pressure, blood flow, and impaired responses or syncope,

Cardiovascular drugs can be divided into several categories, most of which are familiar to physicians. Reparations that are available only as parenreral formulations will be excluded from consideration.

1. Antianginals

Antianginal preparations fall into three general categories: beta adrenergic blocking agents, calcium channel blockers, and nitrates. A

number of preparations are identifiable in each of these three categories, and some differences in effects and side effects are noted among individual drugs within categories.

Beta adrenergic blocking agents can be subcategorized into those that are water soluble and those that are lipid soluble. As; a general rule, the water soluble preparations do not enter the central nervous system except at very high dose levels and do not constitute a safety risk. Lipid soluble beta blocking drugs are more likely Lo cause somnolence and Lo impair reflexes. All beta blockers can produce bradycardia, and in general, sustained bradycardia should be considered a safety problem.

Decisions regarding safe performance of commercial drivers using beta blocking drugs should be based on dose levels and clinical assessment with special attention to manifestations of central nervous system function and heart rate. Answers Lo questions related to state of alertness absence of depression and somnolence, and other side effects are required.

Calcium channel blocking agents vary somewhat in their pharmacologic effects, whereas beta blocking agents are all similar in action.

All such agents currently available in the United States cause a reduction in myocardial oxygen consumption. In addition, diltiazem tends LO reduce heart rate and on rare occasions may cause atrioventricular conduction blockade, whereas nifedipine reduces peripheral vascular resistance more than diltiazem and thus reflexly may accelerate heart rate. Verapamil may cause a reduction in ventricular contractility, particularly in patients already suffering from ventricular dysfunction. Verapamil also has a profound effect on heart rate, especially in patients with tachydysrhythmias

In general, commercial drivers receiving calcium channel blockers should be evaluated clinically, and decisions as to safe performance should be made on an individual basis.

Nitrates are now available in many dosage formulations: sublingual, chewable, oral tablets, and capsules, some of which have sustained release and cutaneously absorbable compounds and oral buccal aerosols. Intravenous nitrates are also available for inhospital patients. Nitrates may cause hypotension but usually do not in ambulatory subjects Commercial drivers receiving nitrate therapy should be individually evaluated LO determine the therapy's effects on blood pressure and therefore cerebral perfusion. Drivers who require more than occasional sublingual nitroglycerin should be presumed to have severe coronary artery disease, and therefore determinations about safe performance should be made on this basis.

2. Antidysrhythmics

As a general rule, careful clinical assessment of commercial. drivers receiving antidysrhythmics is required. This is particularly

true because it is now clear that certain mild dysrhythmias occurring in individuals without evidence of heart disease are quite benign. In addition, the use of antidysrhythmics often fails to produce any benefit in benign ectopy situations, and therefore such medications should not be prescribed at all in these patients.

In individuals with more serious dysrhythmias, it is now evident that antidysrhythmics often cause a worsening of ectopy rather than an improvement. Therefore, every patient who requires an antidysrhythmic should undergo a comparative evaluation before and after the drug is prescribed to determine whether it improves the ectopy, does not affect the ectopy, or worsens the condition. This can be accomplished by ambulatory electrocardiographic monitoring (Holter) in many instances.

A classification of antidysrhythmics in common use follows:

IA - Disopyramide, quinidine, procainamide
IB - Hydantoin, lidocaine, tocainide, mexilitene
IC - Flecainide, lorcainide, encainide
11 - Beta adrenergic blocking agents
III - Amiodarone, bretylium, sot.0101
IV - Calcium channel blocking agents
V - Digitalis preparations

Group IA-B-C drugs are remarkably safe. Group IA-B-C drugs usually do not produce adverse hemodynamic effects, but such drugs often result in serious adverse side effects, and drug sensitivities are common. Caution should be exercised in this regard.

Group II drugs are considered among the antianginal preparations.

Group III drugs, especially amiodarone, are used for very serious conditions, often for prevention of recurrence of sudden death. Commercial drivers requiring Group III antidysrhythmics should be evaluated on the basis of their underlying heart disease with the recognition that sudden death prevention is not always successful.

Group IV and V drugs are covered elsewhere in this report.

3. Anticoagulants

Warfarin sodium is the only oral anticoagulant in general use today in the United States. Its mechanism of action is dependent on its ability to depress hepatic production of several clotting factors, most notably prorhrambin. Patients receiving warfarin sodium are at risk for hemorrhage secondary to trauma and, more rarely, spontaneous bleeding. Operation of a commercial vehicle while anticoagulated with warfarin sodium should be prohibited.

Aspirin and dipyridamole inhibit platelet function and through this mechanism tend to prevent thrombus formation on abnormal arterial endothelial surfaces. The risk of complications from these two perpar-

Lions is low, and their use, in and of itself, should not adversely affect safe operation of a commercial motor vehicle.

4. Antihypertensives

The antihypertensive drugs in common use can be divided into several groups: beta adrenergic blocking agents, calcium channel blocking agents, central alpha 2 adrenergic blocking agents, peripheral vasodilators, sympatholytics, angiotensin converting enzyme inhibitors, and diuretics.

Beta blockers and calcium channel blockers have been considered under antianginal preparations.

The vast majority of mild antihypertensive drugs should be considered safe. However , there are several exceptions.

Methyl dopa is a central alpha 2 adrenergic antagonist and at higher dose levels may produce somnolence. An individual evaluation should be conducted on any commercial driver receiving more than 750 mg per day.

Clonidine and guanabenz, which belong Lo the same category, also produce somnolence. Anyone receiving clonidine or guanabent should be carefully evaluated.

Prazosin, a peripheral vasodilator can produce somnolence, depressed reflexes, syncope, and other central nervous system effects. Although quite safe in general use, it is advisable to evaluate every commercial driver using prazosin.

Reserpine, alone or in combination with other preparations, may cause somnolence and usually adversely affects reflex responses. Reserpine is not in great general use, and its use is not recommended for commercial drivers. But if it is prescribed, drivers should be individually evaluated.

Guanethidine and guanadrel are postganglionic sympathic blocking agents, and their adverse reactions and side effects are similar to those of reserpine. Individual commercial driver evaluation is appropriate.

The use of angiotensin converting enzyme (ACE) inhibitors and hydralazine require special comment.

Enalaprll and captopril are two currently available ACE inhibitors. Others will soon be released. They are both effective vasodilators and as such have proved effective in the management of hypertensive patients.

They both have proved to be safe in general use and currently are beginning to be used more widely in the treatment of mild hypertension. Therefore, their use no longer should be considered as necessarily indicating severe hypertension. Patients receiving ACE inhibitors should be checked for postural hypotension.

ACE inhibitors have also proved very useful in the management of advanced left ventricular dysfunction. Commercial drivers who receive ACE inhibitors Lo facilitate improved ventricular function, rather than for hypertension, should be presumed Lo have severe heart disease and for this reason should be considered Lo be at unacceptable high risk as drivers.

The same is true for hydralazine, a vasodilator antihypertensive. When used as an antihypertensive, no real safe performance problem exists. However, when hydralazine and nitrates are used in combination Lo treat impaired ventricular function, a presumption of severe heart disease-is warranted, and therefore operation of a commercial motor vehicle should be prohibited.

Although the use of diuretics as antihypertensives is usually quite safe, it is advisable Lo assure that appropriate potassium supplementation is provided and that serum potassium levels are in the normal range.

5. Cardiac glycosides

A number of cardiac glycosides are available, digoxin being the one in most common use today. These digitalis-like preparations are all similar in action and serve two main purposes, to improve myocardial contractile function and to treat or prevent certain cardiac dysrhythmias.

In the first instance, cardiac glycosides are used LO treat heart failure, whether or not it is associated with congestion. Digitalis like preparations, when used in proper therapeutic dosage, do not constitute a safety hazard. However, in individuals suffering from heart failure, clinical assessment of the severity of myocardial dysfunction is indicated In addition, maintenance of normal serum potassium levels is important if diuretics are employed.

In the second instance, cardiac glycosides are often used LO control the ventricular rate in persistent atria1 tachydysrhythmias by increasing atrioventricular block. In other patients, digitalis is used prophylactically to prevent the occurrence of supravenrricular dysrhythmias. When cardiac glycosides are used LO control ventricular rate, a clinical evaluation is indicated before determinations regarding safe operation of commercial vehicles can be made. When cardiac glycosides are used prophylactically and in therapeutic dose amounts, their use should be regarded as safe as long as the attempted prophylaxis is successful. This may require documentation.

It is now apparent that at least one and perhaps several new medications that improve myocardial performance will soon be released. Data from clinical trials suggest that these medications will be acceptably safe. However, it now appears that these medications will be used almost entirely in patients with advanced left ventricular dysfunc-Lion that precludes commercial driving.

6. Medications for idiopathic hypotension

Several new alpha adrenergic vasoconstrictors are now in clinical trial for the treatment of persistent idiopathic, sometimes orthostatic, hypotension. These medications also appear to be safe, but clinical assessment of individuals receiving such medications should be required with documentation that such individuals are no longer hypotensive. Repeated blood pressure measurements in recumbent, sitting, and standing positions, must be determined to exclude significant hypotension.

Algorithm for commercial motor vehicle operation and cardiovascular pharmacologic agents

1. Obtain a careful drug history. Is the driver taking any cardiovascular medication?

   Yes (go on) No (stop)

2. Determine the diagnoses for which medications are being used and record the dosage schedule. Do the underlying diagnoses prohibit commercial vehicle operation?

   No (go on) Yes (stop driving)

3. Categorize the medications to one of six groups as per the document. Do any of the medications produce adverse effects?

   Yes (go on) No (stop)

4. Can therapy be modified?

   Yes (do so) No (stop driving)*

*If it is not possible to modify a medication program involving drugs with serious adverse effects, a presumption of serious cardiovascular disease is warranted.

Testimony:

I hereby certify that _____, a commercial motor vehicle driver, is free of all serious adverse effects of the following medications:

_____.

_____
(Signature)

_____
(Date)

Appendix A

CONFERENCE
ON
CARDIAC DISORDERS AND COMMERCIAL DRIVERS

Participants

Samuel M. Fox, M.D. (Chairman)
Director
Preventive Cardiology Program
Georgetown University Hospital
Washington, D.C.

Kent Bailey, M.D.
Senior Associate Consultant
Mayo Clinic
Rochester, Minnesota

Jules Eedynek, M.D.
Director
Task Force on Fitness
Department of the Army
Office of the Surgeon General
Falls Church, Virginia

Bernard Bercue, M.D.
Private Practice
Ypsilanti, Michigan

Jeffrey Borer, M.D.
Gladys and Roland Harriman Professor
of Cardiovascular Medicine
New York Hospital
New York, New York

Robert Bruce, M.D.
Professor of Medicine
University of Washington
School of Medicine
Seattle, Washington

Harold Clark
Director of Safety
Thurston Motor Lines, Inc.
Charlotte, North Carolina

Walter Condon, M.D.
Medical Appeals Officer
Federal Aviation Administration
Washington, D.C.

Charles Lorenza Curry, M.D.
Professor of Medicine
Director
Division of Cardiovascular Diseases
Howard University Hospital
Washington, D.C.

Neil Darmstadter
Senior Safety Engineer
American Trucking Association
Alexandria, Virginia

Donald Dawson, M.D.
Program Consultant
International Brotherhood of Teamsters
Concord, Massachusetts

R.V. Durham
Director
Safety and Health Department
International Brotherhood of
Teamsters
Washington D.C.

John W. Eberhard, Ph.D.
Engineering Research Psychologist
National Highway Traffic Safety Administration
Washington, D.C.

Alan Engelberg, M.D.
Director
Department of Public Health
American Medical Association
Chicago, Illinois

Doris Escher, M.D.
Director Emeritus and Senior Consultant
Montefiore Medical Center
Bronx, New York

Gerald Friedman, M.D.
Medical Director
United Parcel Service
Greenwich, Connecticut

Joe Frith
Director
Environmental Control
Overnight Transportation Company
Richmond, Virginia

J. Caulie Gunnels, M.D.
Professor of Medicine
Division of Nephrology
Duke University Medical Center
Durham, North Carolina

Donald Hanson
Director
Safety Department
Preston Truck Company
Preston, Maryland

Charles Hufnagel, M.D.
Professor of Surgery Emeritus
Georgetown University Medical Center
Private Practice
Spring Valley Medical Associates
Washington, D.C.

Larry Jackson, M.D.
Associate Professor
Department of Cardiology
Georgetown University Hospital
Washington, D.C.

William Johns
Managing Director
American Trucking Association
Alexandria, Virginia

Mark Johnson
Manager
Corporate Safety
Roadway Express, Inc.
Akron, Ohio

Harris Kenner M.D.
Private Practice
Bethesda, Maryland1

Joan Kishel M.D.
Assistant Professor
Uniformed Services University of the Health Sciences
Bethesda, Maryland

Richard Landis
Associate Administrator for Motor Carriers
Federal Highway Administration
Department of Transportation
Washington, D.C.

Cecil Lee
Director
Personnel and Safety
Carolina Trailways, Inc.
Raleigh, North Carolina

Don Leon, M.D.
Professor of Medicine
University of Pittsburgh
Pittsburgh, Pennsylvania

Dennis MCEachedn
Highway Safety Specialist
Federal Highway Administration
Department of Transportation
Washington, D.C.

Paul McHenry, M.D.
Professor of Medicine
Senior Research Associate
Krannert Institute of Cardiology
Indiana University Medical Center
Indianapolis, Indiana

William Mroczek, M.D.
Cardiologist
Cardiovascular Center of Northern Virginia
Falls Church, Virginia

William Oetgen, M.D.
Private Practice
Fort Washington, Maryland

Kenneth Pierson
Director
Office of Motor Carrier Standards
Federal Highway Administration
Department of Transportation
Washington, D.C.

William Roberts, M.D.
Chief
Pathology Branch
National Heart, Lung, and Blood Institute
National Institutes of Health
Bethesda, Maryland

Stephen Scheidt, M.D.
Professor of Clinical Medicine
New York Hospital-Cornell Medical Center
New York, New York

Roy Shephard, M.D.
Director
School of Physical and Health Education
University of Toronto
Toronto, Ontario

David Spodick, M.D.
Director
Clinical Cardiology
St. Vincent Hospital
Worcester, Massachusetts

John Turner
Interstate Driver
International Brotherhood of Teamsters
Washington, D.C.

Ed Westura, M.D.
Director
Intensive Care Unit
St. Mary's Hospital
Leonardtown, Maryland

Zeke Wineglass
Interstate Driver
International Brotherhood of Teamsters
Washington, D.C.

Appendix B

STEERING COMMITTEE MEMBERS

Samuel Fox, M.D. (Chairman)
Director
Preventive Cardiology Program
Georgetown University Hospital
Washington, D.C.

Donald Dawson, M.D.
Program Consultant
International Brotherhood of Teamsters
Concord, Massachusetts

Dr. Gerald Friedman
Medical Director
United Parcel Services
Greenwich, Connecticut

Dr. Charles A. Hufnagel
Professor of Surgery Emeritus
Georgetown University Medical Center
Private Practice
Spring Valley Medical Associates
Washington, D.C.

Dr. Harris M. Kenner
Private Practice
Bethesda, Maryland

Dr. William Oetgen
Private Practice
Fort Washington, Maryland

Dr. E. Westura
Director
Intensive Care Unit
St. Mary's Hospital
Leonardtown, Maryland

Appendix C

CONFERENCE SPEARERS

Dt. Donald Dawson, Chairman of the Medical Advisory Committee, Teamsters Union

Dr. Samuel Fox, Professor of Medicine and Director of Preventive Cardiology, Georgetown University Hospital

Dr. Gerald Friedman, Corporate Medical Director, United Parcel Service

Richard P. Landis, Associate Administrator for Motor Carriers, Federal Highway Administration, Department of Transportation

Dennis McEachedn Highway Safety Specialist, Office of Motor Carrier Standards, Federal Highway Administration, Department of Transportation

Dr. Roy Shephard, Faculty of Medicine, University of Toronto

The Cardiac Patient and Driving--The Ontario Experience*

by

Roy J. Shephard, M.D., Ph.D.

from

School of Physical and Health Education

and

Department of Preventive Medicine and Biostatistics,

Faculty of Medicine

University of Toronto

Running Head: The Cardiac Driver

Correspondence To: Professor Roy J. Shephard, Director,, School of Physical and Health Education, University of Toronto, 320 Huron Street, Toronto, Ontario M5S 1A1.

*Based in part on a presentation to the U.S. Federal Highway Adminisiration Office of Motor Carriers. Conference on Cardiac Disorders and Commercial Drivers, Bethesda, Maryland, October 1986.

Introduction

The licensing of the postcoronary driver has important implications for highway safety, commercial carriers, and the individual commercial drivers who form a significant segment of the North American labor force. This paper will Lake an epidemiological rather than a clinical approach, exploring the issue of the cardiac driver with particular reference Lo experience gained in the Province of Ontario on their commercial motor vehicle drivers. IL will look at the rights of the drivers of such vehicles as buses and articulated trucks relative Lo the laws of the Province and the official attitudes of the Canadian and Ontario Medical Associations (CMA).[1-3] Specific issues Lo be considered will be whether accidents have meaning and whether cardiac risk factors or overt disease increase the risk of an accident, and if so, by how much? Does a negative stress test exclude this Lype of risk, and finally, how should the rights of the affected driver be matched against Lhose of other road users?

Current Opinions and Legislation

The recommendations of the CMA include 8 weeks off the road for the average driver, but suspension of a bus or articulated truck driver after one heart attack and suspension of taxi, ambulance, and minibus drivers after two heart attacks. Those with one attack of angina or more per week are also to be excluded.' Articulated vehicles are the subject of specific legislation under regulation 462 of the Ontario Highway Traffic Act. Drivers of such vehicles are required Lo undergo a medical examination every 3 years to the age of 65, and annually thereafter. In Canada, as in the United States, no special competence is demanded of the examining physician. He or she must certify, among other things that there is "no medical history of blood clots, heart., or respiratory disease." No special laboratory investigations are required. However, one advantage of the Ontario system over that of most U.S. states is that central records are maintained. (In the United States, the responsibility of record keeping is generally delegated to the commercial carrier, with occasional audit by the Office of Motor Carriers.) During the year 1981, for example, Ontario doctors furnished 89,000 reports to the Provincial Ministry of Transport and Communications In 2,600 cases, the recommendation was for the license LO be downgraded to a lighter class of vehicle or suspended; 162 of the 2,600 drivers, mainly patients with coronary heart disease, applied for a waiver of this recommendation, and for 126 patients the waiver was granted by the medical review board, mainly on the evidence of a favorable exercise stress Lest or 24-hour Holter ECG record, plus a favorable attitude on the part of the patient (for instance, recognition of Lhe need Lo avoid lifting). Where the license was denied, possible options open LO the patient were appeal Lo a lay body, the Ontario Driver 'License Suspension Appeal Board, and subsequently LO the county or district court. However, the CMA has criticized the existence of a waiver process as "irresponsible."

The current CMA position regarding Lhe cardiac driver seems based on Lhe collective judgment of a panel. of doctors rather than upon any

clear weighing of objective evidence. Canadian doctors, in general, have concluded it is irresponsible to allow articulated truck drivers to retain a license after infarction. It is argued the truck drivers cannot choose their hours of duty or weather conditions; meals and shifts are irregular; and long periods of driving are required. Moreover, many commercial drivers must be prepared to engage in lifting of heavy cargo, tarpaulins, tires, chains, and coupling units. Nevertheless, if one compares the total number of cardiac patients reported to the Ontario Ministry of Transport and Communications with the likely incidence of ischaemic heart disease in Ontario, it is obvious that the majority of ischaemic episodes in classes of driver other than the heavy truck operator are not reported, despite a legal requirement to do so when the patient's doctor thinks this will impair driving safety. There is an immediate concern about uniformity in the standards applied to the reporting of incidents affecting the general driver. Looking at the cases that have been reported, a total of 565 recent suspension waivers by the medical review board (the majority for cardiac disease) yielded four recurrent infarcts and zero vehicle accidents (over a 3-year followup)--hardly an "irresponsible" statistic.

The Meaning and Causes of Road Accidents

This brings us to the difficult problem of hermeneutics--do accidents indeed have meaning, or are they the random "act of God," beloved phrase of the insurance industry?[5] Notice immediately that whereas men have a realistic perception of the overall risk of fatality from vehicles, 'women overestimate this risk while students underestimate it (table 1). Moreover, most people regard heavy trucks as a large source of the total risk. The causes of road accidents are complex, and it. is rare that cardiac disease bears the primary responsibility. There have been quite .a number of documented incidents involving private aircraft, and there is some evidence that a heart attack was responsible for one commercial aircraft accident that occurred while landing at London airport [6-7] However, an aircraft is a somewhar special case; unless there is dual control[8], the task of flying cannot be abandoned immediately when symptoms are sensed.

It might be argued that the stress of operating a vehicle in heavy traffic or in bad weather increases Lhe risk of a cardiac catastrophe. In Lhe case of British busmen, the work of Norman[9] and Jeremy Morris (personal communication) showed only very rare nonfatal cardiac incidents, with no difference in the number of heart attacks between the drivers of "red" buses (which operated in the stressful environment. of Central London) and the "green" buses (which operated on quiet rural route's). On the other hand, weather is a factor in Canada. In 1981, road conditions contributed to many trucking accidents. In 24 percent, the highway was wet, in 10 percent there was snow, and in 6 percent, there vas ice.[2]

Sudden Cardiac Death and Road Accidents

Norman has argued that the typical road accident occurs in 5 seconds or less.[9] Our studies of middle-aged men undergoing postcoronary

rehabilitation suggest that the durarion of heart attack symptoms usually would be sufficient Lo allow the driver to pull a vehicle LO the side of the road, and in many ubstabces a determined individual could even drive LO the hospital. A cardiac crisis is commonly preceded by 6 to 24 hours of malaise. Thereafter, acute symptoms typically last for 30 minutes, although in 25 percent the duration is less than 30 seconds, and in 14 percent it is less than the critical interval of 5 seconds.[10] In the specific case of a cardiac incident, the time involved comprises not only stopping the vehicle, but also recognition of illness, which may occupy 5 to 10 seconds.

Impact of Cardiac Disease Relative to Effects of Aging

We must now rate the risk of a cardiac incident in the postcoronary patient relative LO that of the average middle-aged driver. In the general population aged 35 to 64 years, cardiac deaths average about 4.6 per 1,000 men-years, and 1.3 per 1,000 women-years.lO Moreover, on moving from the age group of 40 Lo 44 years to 60 LO 64 years, there is a tenfold LO eleven-fold increase in the risk of a heart attack, and a 26-fold increase in the risk of a cardiac death. Our figures for the somewhat slected group of patients who have successfully undergone cardiac rehabilitation at the Toronto Rehabilitation Centre show in year 1 a sixfold increase of cardiac incidents and a fifteenfold increase of deaths relative LO age-matched adults from the general population.[10] In year 2, this drops to fivefold and tenfold increase of risk, respec-Lively, and in years 3 to 5, the increase in risk is only threefold. At this stage, it is clear that the added risk Incurred by a postcoronary patient is less than the risk associated with 10 to 15 years of aging in a normal adult.

Place of Laboratory Tests in Evaluation

How useful is a stress test in making a recommendation on either initial qualification or return Lo driving following infarction? We are immediately faced with Bayes theorem, which in essence expresses the difficulty of detecting a rare event. Table 2 shows, in matrix form, the lo-year prognosis for a recurrence of infarction in relation to the stress Lest result. A positive stress test result after infarction implies that the risk of recurrence is increased by a factor of 2.29 relative Lo those with a negative test. Nevertheless, a positive Lest result is more often wrong than right.[10-12] On the other hand, a negative stress Lest is correct in almost 90 percent of patients, the risk with a negative test being only 75 percent of the standard value for an average member of the postcoronary population. The accuracy can of course be improved further by requiring additional tests such as echocardiography, thallium scintigraphy, and angiography, although the cost of such testing is substantial and might not be covered by health insurance either in Canada or the United States.

Specific Hazard Presented By the Postcoronary Truck Driver

Many ordinary Canadians perceive heavy trucks as nasty, dangerous things. Let us now examine the validity of this perceived risk from the operation of heavy vehicles. In Ontario, heavy trucks account for

2 percent of vehicle licenses and 2 percent of property damage accidents. They also account for 1.5 percent of personal injuries, but 7.2 percent of fatal accidents. AL first inspection, heavy trucks thus seem dangerous, but if statistics are expressed in a more valid fashion, per vehicle-mile, the accident rate becomes low for all of these indices.[2]

The overall figures now must be related Lo the specific risks of driving after myocardial infarction. The typical former truck driver who wishes Lo return to work after infarction will be middle-aged and successfully rehabilitated. In years 3 Lo 5 after the heart attack, such a patient has a risk of one cardiac incident in 584,000 hours of life. If they spend this period driving a vehicle at a speed of 100 km/h, this is equivalent to one attack in 50 million km, and if one-third of attacks are fatal, there is one fatal attack in 150 million km of driving. Moreover, let us suppose that one in six of the fatal episodes develops so suddenly that there is difficulty in stopping Lhe vehicle safely. Such episodes then might be anticipated once in every 900 million km driven by a postcoronary patient. This figure next must be related to the current overall accident rate for the Province. On Provincial expressways, there are 0.8 accidents per million km, and this rate rises progressively to 4.3 accidents per million km on our poorest roads. The overall figure is 2.7 accidents per million km of driving, with a death rate of 2.0 per 100 million km, or one fatal accident in 50 million km of driving.

In the case of a truck driver, the annual distance driven is about 150,000 km (although it might be only about a tenth of this for the average person driving an ordinary car). The number of Ontario drivers' operating long-distance trucks is currently about 126,000, roughly proportional to U.S. figures on a population basis. As a group, Lhe heavy truckers cover a total annual distance of 189 x 10^8 km. Assuming their cardiac risk Lo be similar LO that of the general population, a maximum of 15 percent of potential drivers are likely LO be postcoronary cases*, and if they were allowed Lo drive they would cover 28 x 10^8 km per year. Given also the coronary fatality rate of one incident per 900 million km, there would be 3.15 fatal accidents per year. This must be set against the total accident rate for articulated truck drivers, about. 132 fatal incidents per year in the Province of Ontario Thus denial of a license to the postcoronary patients saves at most 2.4 percent of fatal trucking accidents, or 1.8 percent if return to work had been allowed only after demonstration of a negative stress test. The 1.8 percent saving in turn amounts LO no more than 0.113 percent of all fatal road accidents. The calculation that now needs LO be performed is the cost to society of regulations denying employment Lo postcoronary drivers, relative Lo the benefit of the small number of lives that may be saved.

*In fact, truck drivers are relatively young; in the United States, the median age is about 30 years, and numbers decrease rapidly over the age of 55 years.

Perceived Causes of Road Accidents

The Provincial Police keep records of the perceived causes of road accidents[2] and these generally support the view that ischaemic heart disease is not a major highway safety problem. Some 50 percent of accidents arise from a failure to observe the rules of the road, for example, speeding or failing to yield the right-of-way. Mechanical failure is responsible for a further 15 to 20 percent, and a shift of load for a further 10 percent of truck-related accidents. Finally, other road users account for 5 percent of accidents. 'Loss of control of the vehicle, as might be anticipated with a coronary attack, is reported in only 5 percent of Ontario Police records, and only 1 percent of the Ontario Ministry of Transport figures. This accords with world literature, where heart attacks are very rarely cited as causes of even minor accidents in truck and bus drivers (table 3). Certainly, the abuse of alcohol and drugs is a much more important cause of accidents than a recurrence of a coronary attack following myocardial infarction.

Conclusions

By way of summary, what would be the impact of more liberal legislation? One can estimate that in Ontario, the suspension of all articulated truck licenses after infarction currently saves no more than 0.13 percent of fatal road accidents, two or three incidents per year. In contrast with this meager benefit, the prohibition of excessive driving by truck drivers (a factor which doubles the risk of accidents would save 3.6 percent of fatal trucking accidents. Suspension of all post-coronary patients (irrespective of the class of vehicle might save about 5.6 percent of fatal accidents. Some accidents also might be avoided by greater care in the prescription of cardioactive and hypotensive drugs. However, the most effective highway safety measure would be to enforce current blood alcohol limits, since alcohol is responsible for as much as 50 percent of road accidents. Certainly, we could adopt a more liberal attitude to the postcoronary trucker, without exposing other road users to a significant safety hazard, and on a cost-effectiveness scale an attack on alcohol and drug abuse would be at least 100 times more effective as a Lactic for the improvement of road safety.

Table 1. Rank ordering of causes of fatalities--public perceptions of students and adult men and women compared with actual causes, also arranged in rank order (based on data of Upton, ref. 13).

Actual Risk	Perceived Risk		
	Students	Men	Women
Smoking	Nuclear Energy	Guns	Nuclear Energy
Alcohol	Guns	Motorcycles	'Vehicles
Vehicles	Smoking	Vehicles	Guns
Guns	Pesticides	Smoking	'Smoking
Electricity	Vehicles	Alcohol	Motorcycles
Motorcycles	Motorcycles	Firefighting	Alcohol
Swimming	Alcohol	Policework	Aviation
Surgery	Policework	Nuclear Energy	Policework
X-Rays	Contraceptives	Surgery	Pesticides
Railways	Firefighting	Hunting	Surgery

(Upton, 1982)

Table 2. Relationship between exercise test result and lo-year risk of recurrence following myocardial infarction[10].

10-year Prognosis	Stress Test Result Positive	Negative	All CHD Patients
Recurrence	76	74	150
No Recurrence	263	587	850
Total	339	661	1,000

Odds ratio = 587/74 x 76/263 = 2.29

Risk of reinfarction (neg. test) 74/661 = 11.2% in 10 years
More prognostic value than positive test
If test negative, risk 74.7% of that for all CHD

Table 3. Reported natural deaths at the wheel.

Authors	Findings
Baker & Spitz[14]	0/591 collisions due to natural death.
Crancer 6 McMurray[15]	Heart disease gives insignificant increase of risk.
Di Maio[16]	47 natural deaths - 35 collisions, none with major injury.
Herner et al.[17]	41 illnesses at wheel in Zurich over 25 years; 7 died of infarction, but all stopped vehicles safely.
Levy et al.[18]	New York City bus driver died at wheel killing 6 people.
Ludlum[19]	New York City bus drivers. Over 10 years, 5 deaths at wheel in 5,000 drivers, with one minor collision.
Myerburg & Davis[20]	13 of 37 truck drivers dying of coronary disease died in trucks; only minor accidents; 5 of 32 other public vehicle drivers died at wheel, again without serious incident.
Norman9	14 cases of loss of consciousness in 220,000 bus-driver years · 12 of 14 moving, property damage in 3 incidents.
Peterson & Petty[21]	36/71,000 collisions due to natural death, only 1 minor injury.
Trapnell & Greoff[22]	Over 17 years, 12 incidents among 1,300 commercial drivers. No vehicular accidents.
West et al.[23]	155 collisions due to natural causes. 1 fatality (but blood alcohol 220 mg/100 ml). 14 minor injuries.
Wikland[24]	6 of 3,304 coronary deaths in vehicles. No serious accidents.

Appendix E

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AGENDA

Federal Highway Administration
Office of Motor Carriers

Cardiac Disorders and Commercial Drivers

October 30 and 31, 1986

October 30

8:30 a.m.	Continental Breakfast
9:00 a.m.	Call to Order and Introductions --Samuel Fox, M.D., Steering Committee Chairman
9:15 a.m.	Safety Regulations and the Motor Carrier Industry -Richard P. Landis, FHWA Associate Administration for Motor Carriers
9:30 a.m.	Motor Carrier Industry and Medical Regulations: A Management Perspective --Gerald Friedman, M.D., United Parcel Service
9:50 a.m.	Motor Carrier Industry and Medical Regulations: A Labor Perspective --Donald Dawson, M.D.
10:10 a.m.	Questions and Answers
10:30 a.m.	Break
10:50 a.m.	Medical/Regulatory 'Experience in Ontario, Canada -Roy Shephard, M.D.
11:10 a.m. - 11:30 a.m.	Charge to Task Forces -Samuel Fox, M.D.
11:35 a.m.	Task Force Meetings
12:30 p.m.	Lunch
1:30 p.m. - 5:00 p.m.	Task Force Meetings

October 31

8:30 a.m.	Continental Breakfast
9:00 **a.m.**	Task Force--Discussion of Revisions
10:30 a.m.	Break
11:00 a.m.	Task Force Reports
12:30 p.m. - 1:00 p.m.	Closing Remarks --Samuel Fox, M.D. --Kenneth Pierson, Director, Office of Motor Carrier Standards

October 31

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